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WASTEWATER TREATMENT EVALUATION, MATHER AIR FORCE  
BASE, CALIFORNIA

Chester F. Pauls

Environmental Health Laboratory  
McClellan Air Force Base California

June 1974

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WASTEWATER TREATMENT EVALUATION  
Mather AFB CA

By

Chester F. Pauls, Captain, USAF

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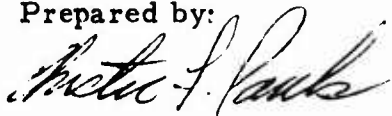
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WASTEWATER TREATMENT EVALUATION  
Mather AFB CA

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(Project No. WDF-202)

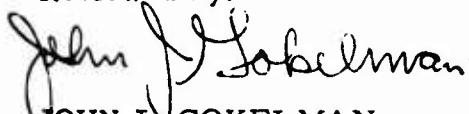
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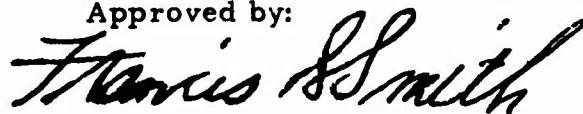
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## ABSTRACT

A survey of the Wastewater Treatment Facilities at Mather AFB was performed. Sources of industrial and domestic wastes were reviewed. Treatment facility performance and effluent characteristics were determined. Recommendations to improve the treatment of wastewater and to eliminate untreated discharges are presented. Performance specifications applicable to the wastewater treatment facility are provided.

## ACKNOWLEDGEMENT

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Finally we would like to thank Capt Bruce Hollett, and TSgt Joseph Peck, for their personal assistance, and for the assistance we received from all Environmental Health Services personnel.

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## SECTION I

### INTRODUCTION

#### 1. Background:

In December 1971, Hq ATC requested that baseline water pollution surveys be conducted at thirteen ATC installations to provide information for future planning purposes, and construction of wastewater treatment facilities. In January 1972, Hq AFLC (SG), directed the Environmental Health Laboratory, McClellan AFB CA (EHL-M), to perform the survey at Mather AFB CA.

A field survey was originally scheduled for August 1972. The field survey was postponed however, because the trickling filter distributor arms at Mather's wastewater treatment facility had deteriorated and required extensive repair to be returned to service. During this same period the digester was out of service for installation of a new mixing device. The repair contractor experienced difficulty obtaining the required parts, and did not complete the repairs until July 1973. By this time the EHL-M survey team was committed to other higher priority projects, and the survey of Mather was tentatively scheduled for the spring of 1974.

During 1973 Mather personnel were in the process of applying for a discharge permit from Region IX, Environmental Protection Agency (EPA), under the terms of the National Pollutant Discharge Elimination System (NPDES) program. The permit application required information about the concentration of various chemical constituents in Morrison Creek, resulting from the discharges of Mather AFB maintenance and operational activities, and from the discharge of the domestic wastewater treatment facility. Mather personnel felt that the information to be generated by the field survey would be helpful for the NPDES permit application, and requested that the field survey begin as soon as possible. The field survey was therefore accomplished during the period 25 November through 6 December 1973. This portion of the field survey was designed primarily to gather information that would be needed for the NPDES permit, with the intention that additional sampling and analysis could be performed in the spring and summer 1974, if it became necessary to recommend major changes in the existing treatment scheme based on the results obtained from the initial field survey (November - December 1973).

This survey utilized all of our available field and analytical manpower, and did not provide for sampling of the metals cleaning and plating facility effluent. In order to obtain some background information about the nature of this discharge, Mather's Bioenvironmental Engineering Services personnel obtained samples of the plating facility effluent during the period 28 through 30 January 1974.

After the completion of the field survey, but prior to the start of data analysis, Hq ATC determined that Mather AFB would participate in the new regional wastewater treatment facility currently being designed for the Sacramento County area. Beginning in the first quarter of 1977 therefore, Mather AFB will discharge its wastewater to the regional system for treatment and will not require a discharge permit for its domestic sewage under current NPDES guidelines.

## **2. Purpose:**

a. To present the results of the field survey conducted during the period 25 November - 6 December 1973, including:

(1) The condition of the existing domestic wastewater treatment facility and the performance achieved by this facility.

(2) The performance of the existing oxidation ponds.

(3) Chemical characteristics of the West Ditch prior to discharge to Morrison Creek.

(4) Recommended performance specifications for the existing facility such that its discharge will meet environmental quality standards.

(5) Recommendations for changes in the operation and maintenance of the existing treatment facility.

(6) Determination of the adequacy of treatment facility laboratory procedures employed for chemical analysis of raw and treated wastewater.

b. To present and interpret the results of chemical analysis of samples obtained from the metal cleaning and plating facility during the period 28 through 30 January 1974.

## **3. Survey Personnel:**

a. The Environmental Health Laboratory on-site survey team consisted of the following personnel:

(1) Capt Chester F. Pauls, Project Officer

(2) Sgt Frank Lessing, Bioenvironmental Engineering Specialist

b. EHL personnel providing daily laboratory analyses during the survey period included:

(1) Capt Michael P. Anderson, Laboratory Chemist

(2) Capt Richard T. Robertson, Laboratory Chemist

(3) Mr Jack E. Greathouse, Laboratory Chemist

(4) SSgt Thomas R. Doane, Environmental Engineering Specialist

c. The following Mather AFB Environmental Health Services personnel performed sampling duty for the survey team on a 12 hour shift basis during the entire survey period:

(1) SSgt Glenn Bohley, Environmental Health Specialist

(2) Sgt Ben Kelly, Environmental Health Specialist

These personnel were relieved periodically by TSgt Joseph Peck, Environmental Health Technician, and assisted by the Civil Engineering military operator on duty at the wastewater treatment facility.

d. Capt Bruce Hollett, Mather Bioenvironmental Engineer, and TSgt Joseph Peck, Environmental Health Technician collected and performed all bacteriological analyses.

## SECTION II

### DESCRIPTION OF INSTALLATION

#### 1. General Description, Mather AFB:

a. Mission: Mather AFB is situated in Central California, in the Sacramento Valley approximately 12 miles east of the city of Sacramento. The base's primary mission is to qualify non-rated officers as navigators, and to provide the navigator with the technical training, experience, guidance and motivation, required to operate the advanced navigation, bombing, missile and electronic warfare systems used by the USAF. Mather's secondary mission is to provide support for the 320th Bombardment Wing, the 3506th Recruiting Group, the Army National Guard, and seven other tenant organizations.

b. Housing: The on-base family housing area is located in the southeast portion of the base and consists of four appropriated units, 750 Wherry units, and 450 Capehart units. There are 67 three-man bachelor officer quarters of residential type located south of the family housing area. In addition, there are several other facilities in the cantonment area that provide housing for 222 officers. Airmen dormitories, located on the west side of Mather drive, northwest of the cantonment area, provide housing for 1120 personnel. There are also five, 16-man airmen dormitories for SAC Security Police located east of the family housing area.

c. Water Supply: The base potable water is supplied by five separate water systems. The housing area and the main base systems are the largest of the five systems. The housing area system is composed of five wells

with a combined pumping capacity of 5.1 million gallons per day (MGD), and a 500,000 gallon elevated steel storage reservoir. The main base system is served by four wells with a combined rated capacity of 4.7 MGD, a surface level water reservoir and elevated steel storage reservoir having a combined capacity of 950,000 gallons. Three relatively small potable systems are provided for the SAC Jet Engine Test Stand, SAC Ordnance Area, and the SAC Combat Defense Force Area.

## 2. Wastewater Sources and Wastewater Collection System:

a. Sewage Collection System: The sewage collection system is divided into four distinct sections, each connected to the treatment facility interceptor by an individual trunk line. Trunk lines from the main base area, and the SAC Combat Defense Force Area, combine into a 21 inch sewer at manhole (MH) number 2, while trunk lines from the Wherry and Capehart housing areas combine with this 21 inch sewer at MH number 400, approximately 115 feet NNW of facility 7125, the treatment facility raw sewage pump station. The trunk line from the main base carries the wastewater generated by maintenance and operational activities in addition to routine domestic wastes. Figure 1 depicts the general layout and relative location of Mather AFB facilities. Industrial (non-domestic) wastes from maintenance and/or operational activities, which discharge to the sanitary sewer occur from the following sources:

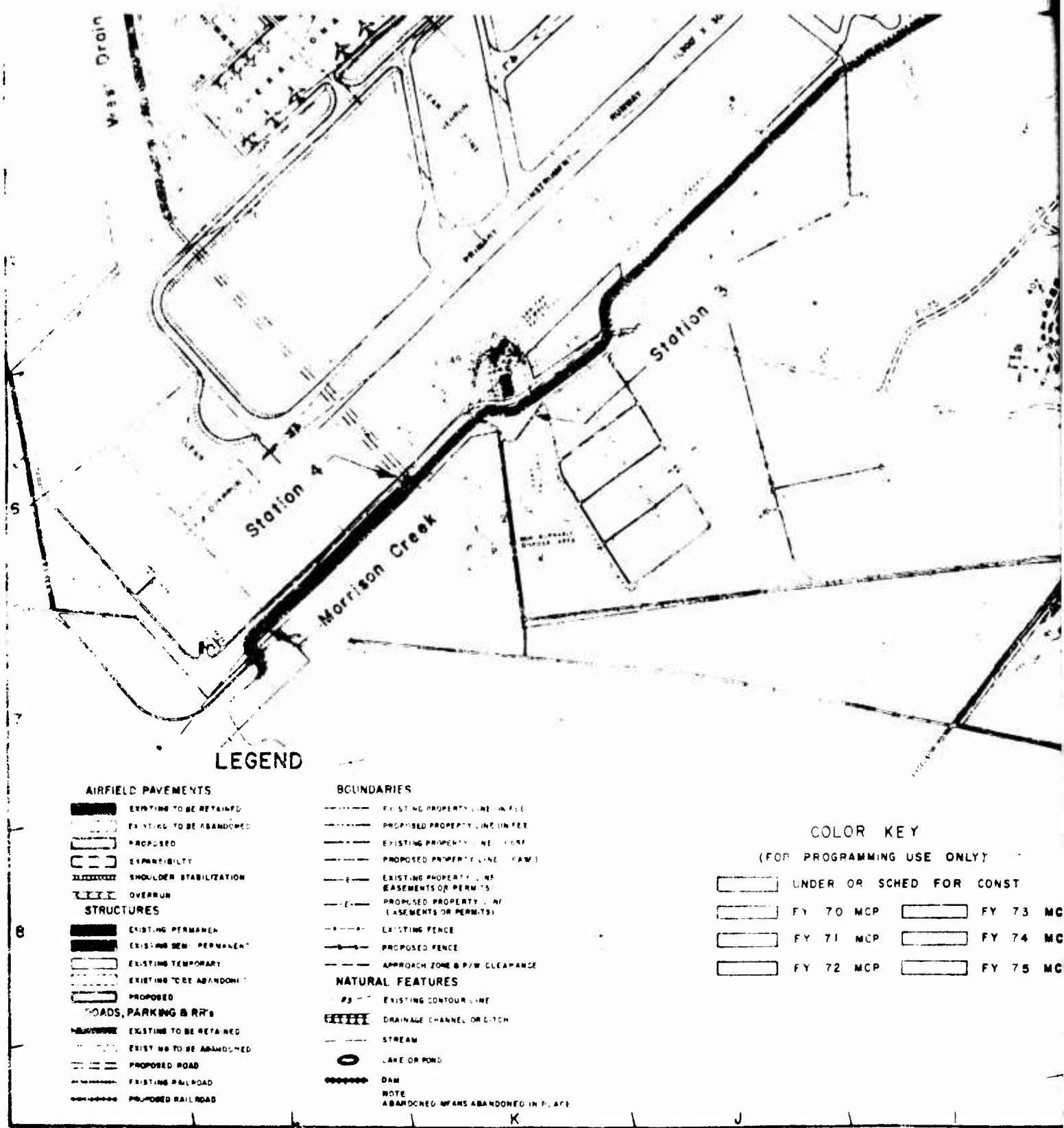
(1) Composite maintenance facility, Bldg 4150. Waste discharges include rinse water from the metals cleaning and plating shop, neutralized battery acids from the battery shop, and overflow from the spray booth waterfall in the paint shop.

(2) Effluent of oil skimmers serving the Aircraft and Aerospace Ground Equipment (AGE), washracks and corrosion control facilities listed in Table I.

TABLE I

### SUMMARY OF MATHER AFB WASHRACKS

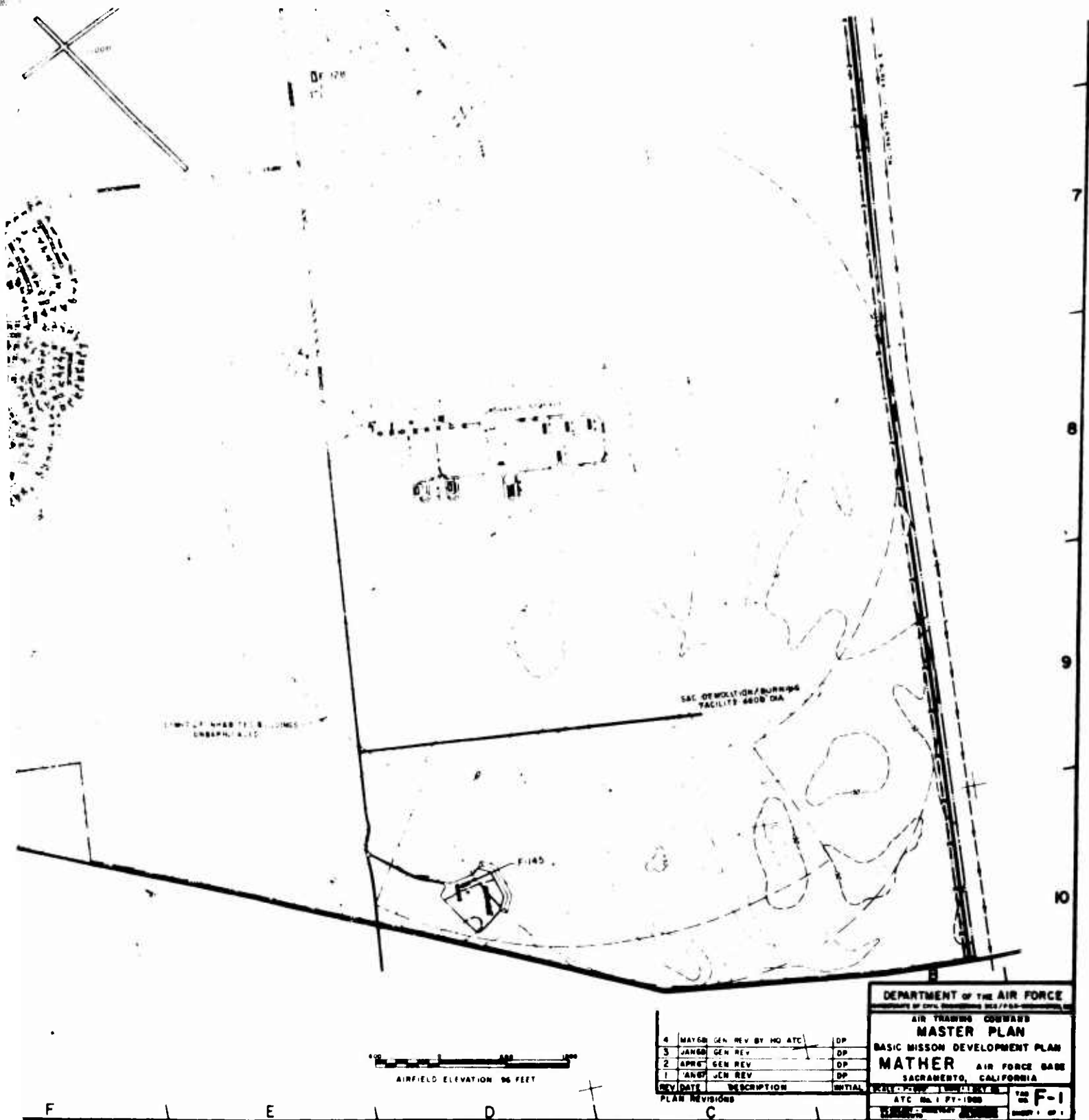
<u>Facility Number</u>	<u>Designation</u>
3990	ATC Aircraft -
4770	ATC Aircraft & AGE -
4250	ATC Aircraft -
7022	SAC AGE -
7035	SAC Corrosion Control -



A

Mather AFB Fe

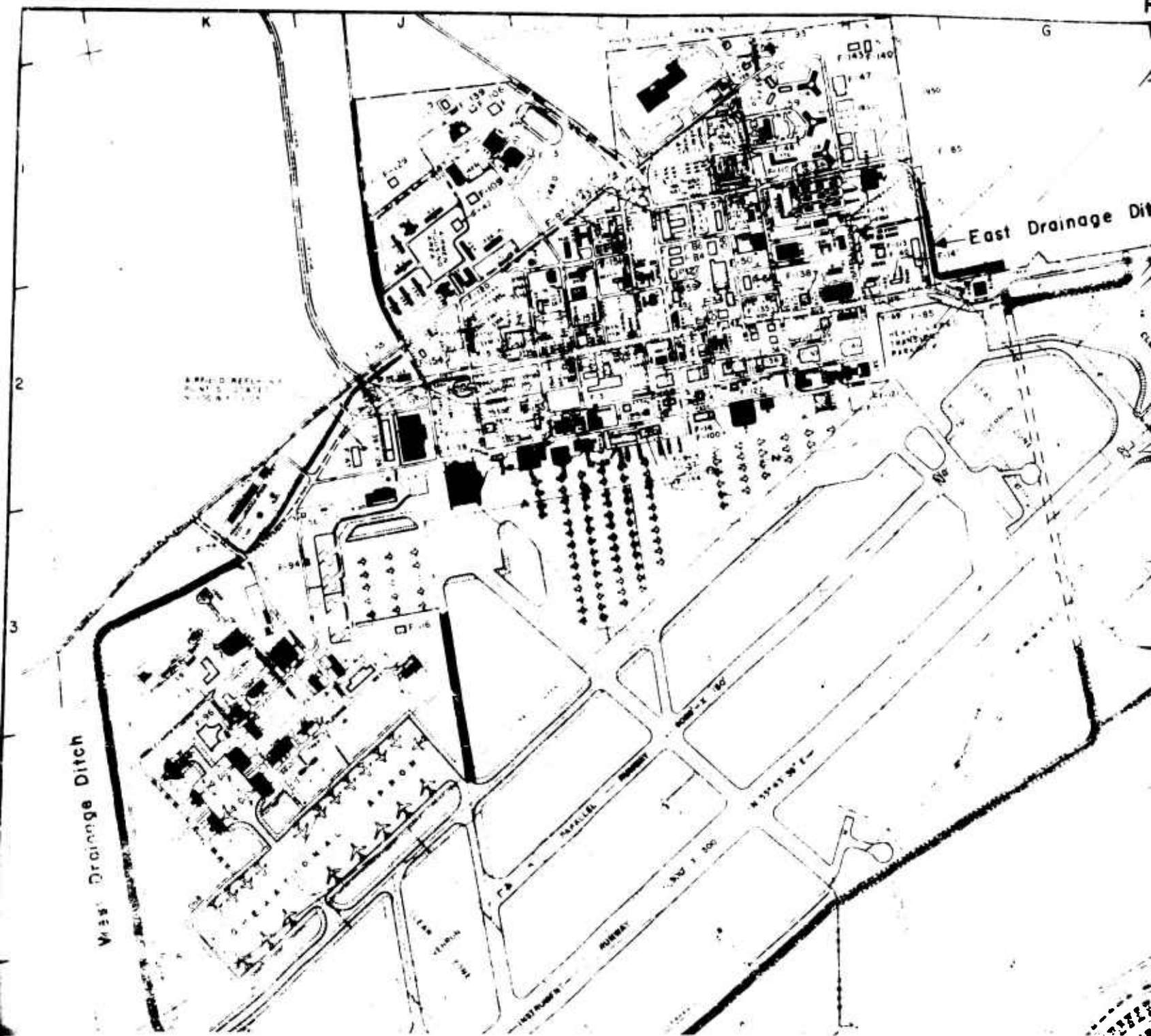




Locations

C

2

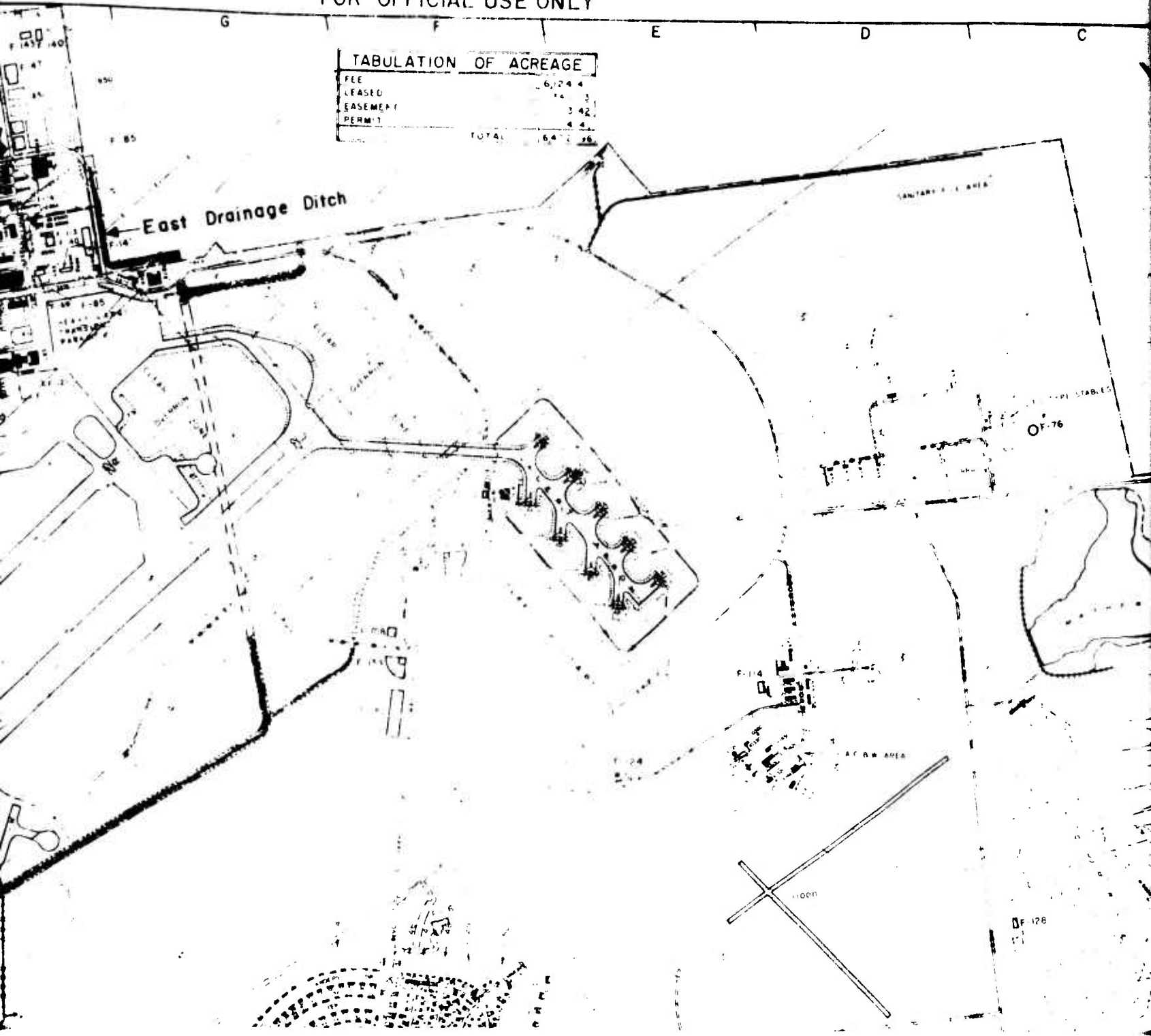




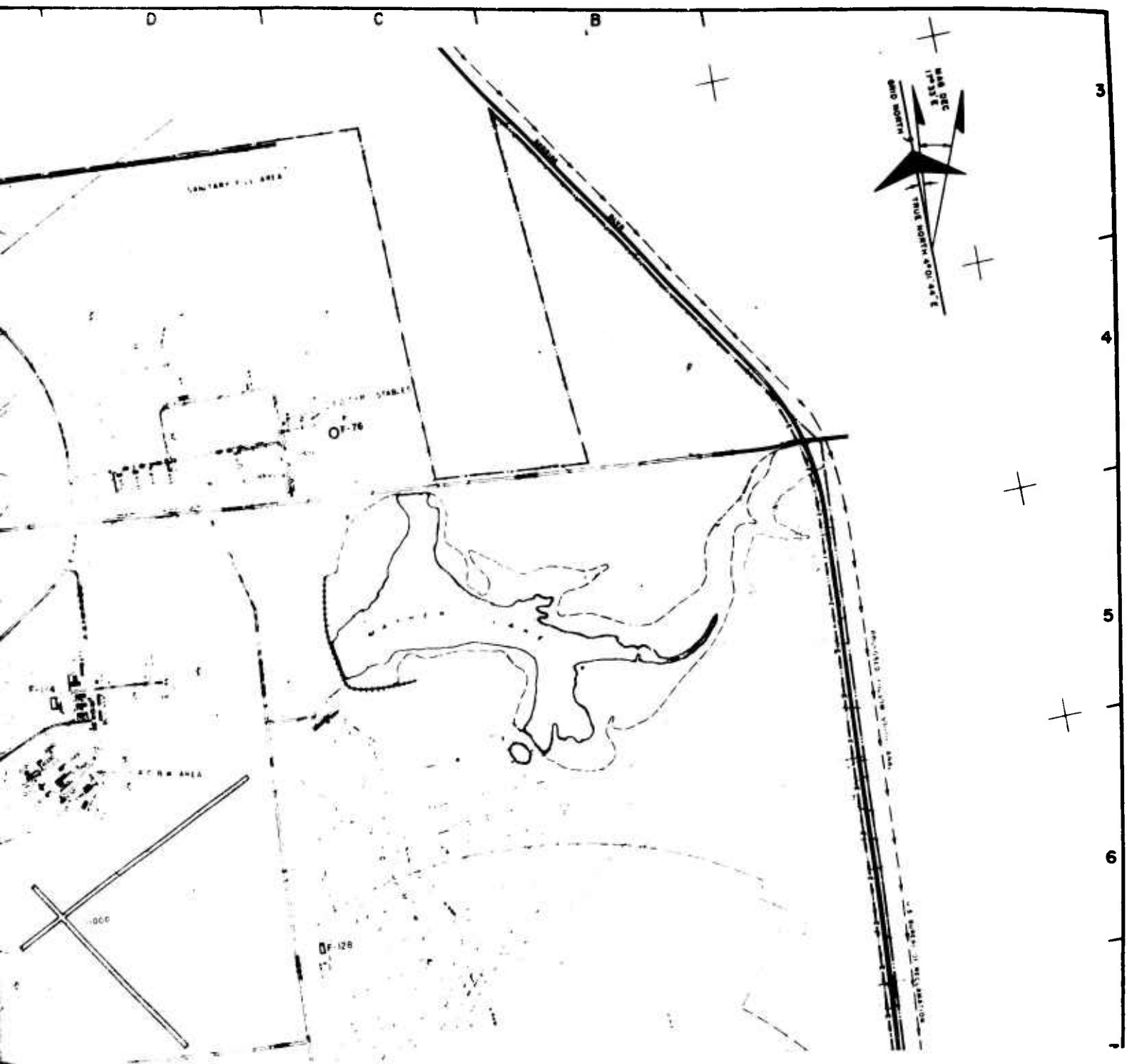
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TABULATION OF ACREAGE	
FEE	6,124.4
LEASED	16.3
EASEMENT	3.42
PERMIT	4.4
TOTAL	6,148.52



F



(3) Photo processing activities located in Bldg 2890, the base photo shop and Bldg 2425, the base photo hobby shop.

(4) Dental and Medical X-Ray development accomplished in Bldg 650, USAF Hospital, and Bldg 1766, Preventive Dentistry.

(5) X-Ray development accomplished in Bldg 4260, non-destructive inspection shop.

b. Other Systems: Wastewater from the under drains of gravity oil separators located at facilities 2898, 2990, 3320 and 7009, discharge to the storm drainage system which eventually discharges to Morrison Creek. The vehicle washrack at the base motor pool discharges to the east drainage ditch which traverses the base runway and eventually becomes Morrison Creek.

### 3. Wastewater Treatment:

Mather AFB wastewater conveyed to the treatment facility is provided with secondary (biological) treatment and chlorination followed by polishing lagoons prior to being discharged to Morrison Creek. Treatment facility unit processes include:

a. Pre-treatment consisting of solids shredding by barminutor or comminutor.

b. Primary sedimentation (clarifier).

c. Biological oxidation by trickling filter.

d. Secondary sedimentation (clarifier).

e. Chlorination.

f. Flow measurement.

g. Polishing lagoons.

h. Anaerobic Sludge Digestion.

i. Sludge drying on sand beds.

In this report, processes a through f above, will be referred to as "first stage" and the polishing lagoons will be referred to as the "second stage" of the overall treatment process. Solids (sludge) removed from the wastewater in the secondary clarifiers are pumped to the treatment facility influent channel upstream from the primary clarifiers. Solids removed from the primary clarifiers are pumped to the anaerobic digesters for treatment. Following digestion the sludge is piped to the sludge drying beds where, after a suitable drying period, the sludge is removed

from the beds, transported to the golf course compost pit, and eventually used as a soil conditioner. Figure 2 depicts the plant layout, while Table 2 provides unit sizing information.

4. Wastewater Discharges:

Mather AFB discharges storm water runoff, treated domestic and industrial wastewater, and a minor amount of wastewater from gravity oil separators, and the motor pool vehicle washrack to Morrison Creek. Morrison Creek is a sluggish drainage channel which originates, during dry weather, at Mather AFB, and meanders through Sacramento County in a southeasterly direction, approximately 25 miles, and terminates in Snodgrass Slough. In this distance it is impounded by a series of lakes and receives additional wastewater discharges from industrial and domestic sources. Snodgrass Slough discharges to the Sacramento River below the City of Sacramento.

5. Applicable Water Quality Criteria and Regulations:

a. Executive Order 11752 <sup>(2)</sup> requires that the "... Federal Government, in the design, construction, management, operation, and maintenance of its facilities, shall provide leadership in the nationwide effort to protect and enhance the quality of our air, water, and land resources through compliance with applicable standards for the prevention, control, and abatement of environmental pollution in full cooperation with state and local governments."

b. Air Force Regulation 19-1 <sup>(3)</sup> provides USAF policy in regard to pollution abatement and environmental quality. This policy requires the USAF to "demonstrate leadership in preventing, controlling, and abating environmental pollution at Air Force installations, by supporting area pollution-abatement programs of local communities and by accelerating corrective measures, to meet established standards and criteria." AFR 19-1 requires that Environmental Health Laboratories develop performance specifications when they perform consultant surveys concerned with water quality. Performance specifications are defined as permissible limits of emissions, discharges, or other values applicable to a particular facility that would, as a minimum, provide for conformance with environmental quality standards. Recommended performance specifications for Mather's wastewater treatment facility are provided in Appendix I.

c. Current discharge requirements for Mather AFB wastewater are provided in two resolutions passed by the California Regional Water Quality Control Board (CRWQCB), Central Valley Region. Resolution Number 117, passed in February 1952, applies to discharges from the sewage treatment facilities to Morrison Creek, while Resolution Number 61-150, adopted December 1961, governs the nature of industrial waste discharge to Morrison Creek. Copies of these resolutions and related information are provided in Appendix II.



Polishing Lagoons

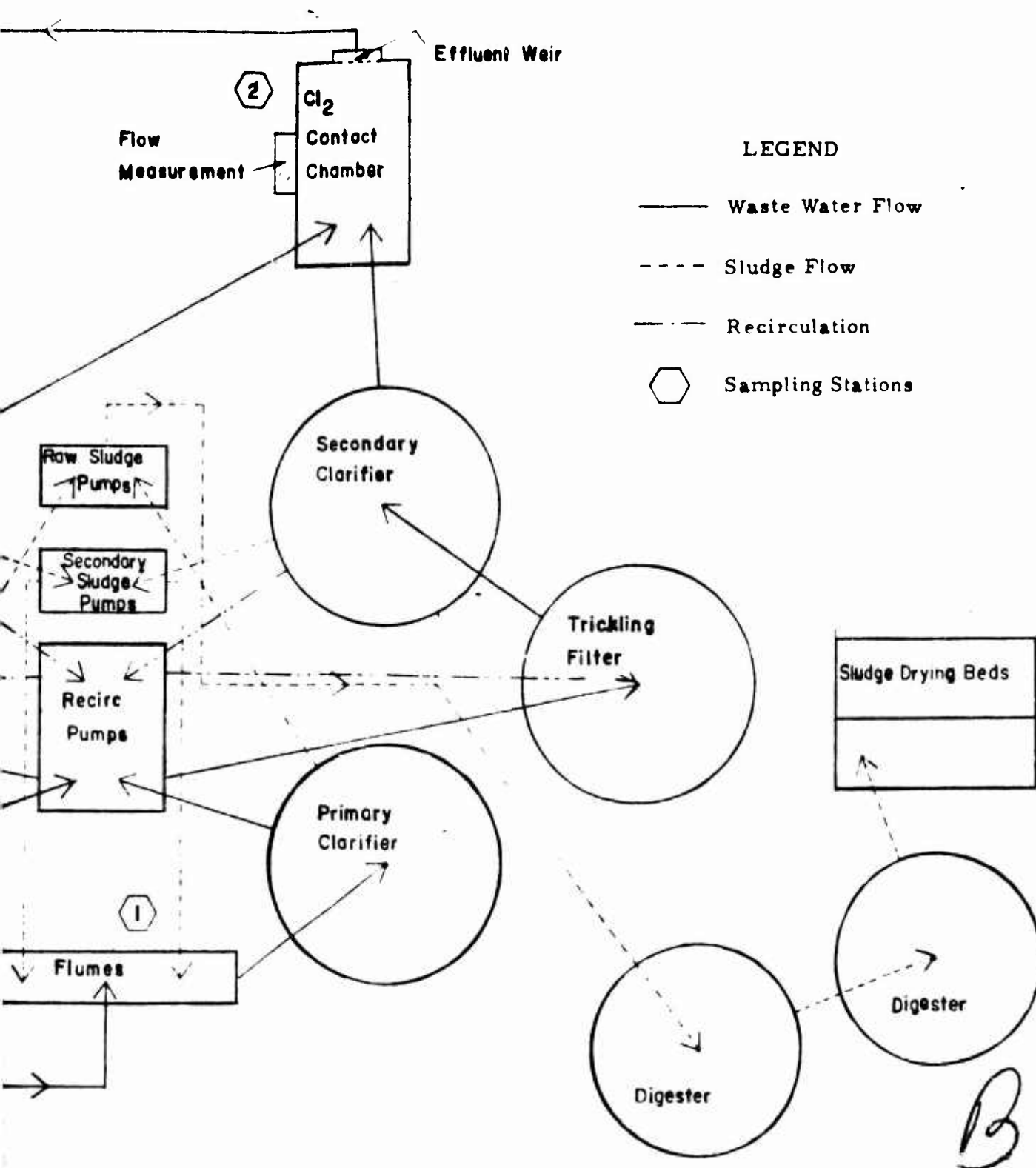


Figure 2

WASTEWATER TREATMENT FACILITY LAYOUT AND SAMPLING STATION LOCATIONS

# MATHER AFB UNIT PROCESS DESCRIPTION

Unit	Quantity	Dimensions and/or Capacity Per Unit
Influent Lift Station Pumps	4	Design Capacity - 3 at 835 gpm (electric) 1 at 2,500 gpm (full throttle gasoline engine)
Parshall Flume *	2	Throat Width 6 Inch Capacity 0.032 - 1.99 MGD
Primary Clarifier	2	Diameter 35 Ft Side Wall Depth 5 Ft Volume 39,485 Gal. Surface Area 962 Ft <sup>2</sup>
Trickling Filter	2	Diameter 55 Ft Surface Area 2376 Ft <sup>2</sup> Depth 3 Ft Volume 7127 Ft <sup>3</sup>
Final Clarifier	2	Diameter 35 Ft Side Wall Depth 5 Ft Volume 39,485 Gal. Surface Area 962 Ft <sup>2</sup>
Chlorinator	1	Max. Feed Rate Not Known
Recirculation Pumps	3	Capacity Unknown
Effluent Lift Station Pumps	3	Design Capacity Same as influent Lift Station
Polishing Lagoons	4	Approximate Depth 4.5 Ft Approximate Volume (Ft <sup>3</sup> x 10 <sup>6</sup> ) Lagoon 1 - 1.56 Lagoon 2 - 1.47 Lagoon 3 - 1.49 Lagoon 4 - 1.34
Digester - Primary	1	146,870 Gal.
Digester - Secondary	1	147,240 Gal.
*Not Currently in Use		

In the future, wastewater discharges will be governed by the conditions stated in the National Pollutant Discharge Elimination System (NPDES) permit currently under preparation by the Environmental Protection Agency (EPA).

d. Title 40 of the Code of Federal Regulations, Part 413 (40 CFR 413), contains the provisions applicable to discharges of pollutants resulting from a process in which a ferrous or non-ferrous base material is rack or barrel electroplated with copper, nickel, chromium, zinc or any combination thereof. This regulation is applicable to the discharge from Mather's plating facility and is provided in Appendix III.

#### 6. Treatment Facility Operating Configuration During Survey Period:

The general flow scheme for the Mather AFB wastewater treatment facility is presented in Figure 2. Wastewater arriving at the facility passes through a comminutor or barminutor before entering the lift station wet well. The lift station is provided with three motor driven 835 gallon per minute (gpm) pumps and an engine driven 2,500 gpm (full throttle) pump for emergency operation. During the survey period one of the 835 gpm pumps was inoperative, causing the 2,500 gpm pump to operate during periods when the influent flow rate was high. After being pumped from the lift station wet well, the wastewater flow is divided and passes through Parshall flumes before entering the center cones of the primary clarifiers. Settleable solids removed from the waste stream accumulate as raw sludge in the primary clarifier sludge hoppers, from which it is pumped, automatically, to the primary digester. The sludge pumps are set to cycle every 60 minutes, and pump at a rate of approximately 80 - 100 gpm. Total raw sludge pumped to the primary digester daily, is estimated by plant operators to be 2000 - 2,500 gallons at 5% solids. Primary clarifier effluent is discharged to the wet well serving the three recirculation pumps which discharge to the trickling filters. The pumping capacity of these pumps is unknown and cannot be accurately determined with existing plant equipment. The total daily recirculated flow, therefore, is not known. After being applied to the rock media trickling filters, the wastewater trickles vertically downward to the filter underdrain system, from which it is discharged to the final clarifier. Here, settleable solids separated from the wastewater accumulate as sludge and are raked to the sludge hoppers from which it is continuously pumped to the influent wastewater line upstream from the primary clarifiers. Pipes connecting the secondary clarifiers, with the wet well of the recirculation pumps, permit an undetermined amount of wastewater to return, by gravity, to the recirculation pumps.

The effluent from the two secondary clarifiers is combined at the entrance to the chlorine contact chamber. Following chlorination, the wastewater flows to the wet well of the effluent lift station from which it is pumped to four polishing lagoons which are operated in series. Following an approximate total detention period of 40 days, the final effluent is discharged to Morrison Creek approximately 0.7 miles upstream from



the point that Morrison Creek departs the confines of the base.

### SECTION III

#### SURVEY TECHNIQUE

##### 1. Sampling Station Locations:

a. In order to meet survey objectives routine sampling stations were established at the locations described in Table 3, and shown in Figures 1 and 2.

b. Samples were obtained from the effluent lines of the oil separators serving the aircraft and AGE washracks following periods that these facilities were operational if sampling manpower was available.

c. During the period 28 through 30 January 1974, Mather Bioenvironmental Engineering Services personnel obtained samples from the effluent sewer serving the metal cleaning and plating operation in facility 4150.

TABLE 3  
ROUTINE SAMPLING STATION LOCATIONS

<u>Station</u>	<u>Location</u>
1	Raw sewage at Parshall flume.
2	Chlorinated effluent of first stage treatment.
3	Effluent of polishing lagoons.
4	West ditch $\approx$ 75' upstream from its confluence with Morrison Creek.

##### 2. Sample Collection Technique:

a. Chemical Analyses: Samples from stations 1, 2 & 3 were collected manually, each hour, proportional to flow rate at the time of collection, for 24 hour periods, beginning 0800 each day and terminating at 0700 the following day. Samples collected at station 4 (west ditch) were 24 hour, composite, constant volume samples, rather than flow proportional, since accurate continuous flow measurement was not possible at this station. Samples collected from aircraft and AGE washrack operations were obtained hourly from the discharge line of the respective oil skimmer on a constant volume basis, over the work period (usually 4-8 hours). All of the above samples were cooled to approximately 32°F during the collection period by immersing the sample container in crushed ice. At the end

of the sample collection period, aliquotes of every sample were poured to separate containers, containing preservatives for specific chemical constituents. Samples collected during 28 - 30 January 1974 from the sewer serving the metals cleaning and plating facility, were obtained with a Brailsford Model DU-2 automatic sampler over two eight hour shifts per day. These samples were collected continuously, on a constant volume basis, into a container already containing nitric acid preservative. All samples were transported to the EHL-M, and constituents subject to rapid change were analyzed upon arrival at the laboratory by Special Projects Division. Samples analyzed for stable constituents, were processed with the routine workload by the Analytical Division.

b. Bacteriological Analyses: Grab samples were obtained daily during periods of highest treatment facility flow rate, for bacteriological analysis. Samples were analyzed immediately following collection for total coliform, fecal coliform, and fecal streptococci bacteria concentrations, utilizing the membrane filter technique.

### 3. Flow Measurement Technique:

a. General: As shown by the flow schematic (Figure 2), wastewater entering the treatment facility is split into two parallel flow systems. The flow is split at two Parshall flumes upstream from the primary clarifiers, and recombines at the entrance to the chlorine contact chamber.

b. Station 1: Stevens Type F flow level recorders were installed in the stilling wells of the Parshall flumes to measure flow rate at Station 1, and to determine if the flow to each half of the plant was equal.

c. Station 2: The effluent channel of the chlorine contact chamber is provided with a variable crest length rectangular weir. The crest was set at 25 inches for the duration of the study and upstream head was measured by means of a Stevens Type F flow recorder at a stilling well connected to the chlorine contact chamber.

d. Station 3: The effluent channel of the polishing lagoons is provided with a 12 inch Parshall flume. The stilling well of the flume was equipped with a Stevens Type F flow level recorder to allow measurement of upstream head ( $H_a$ ) during the survey period.

e. Station 4: It was not possible to install a critical section in the west ditch to enable constant flow rate recording. Flow rate was determined periodically at this section by means of a Gurley meter traverse.

### 4. Analyses Performed:

a. Analyses routinely performed on samples from stations 1 through 4 are presented in Table 4.

b. Dissolved Oxygen (DO) and temperature were measured approximately every four hours at stations 1 through 4 using a YSI model 54 dissolved oxygen meter.

c. Grab samples were obtained approximately every four hours for settleable solids determinations at stations 1 - 3.

d. Hydrogen ion concentration (pH) was determined continuously by a Rustrak, model 30, portable recorder at station 1. Mechanical difficulties experienced with this instrument however, precluded its use for the entire survey period. Hydrogen ion concentrations (pH) were therefore measured in the laboratory on an aliquot of the unpreserved, refrigerated, composited samples from all stations.

TABLE 4  
ANALYSES PERFORMED ON SAMPLES FROM VARIOUS  
SAMPLING STATIONS

<u>Analysis</u>	<u>Abbreviation</u>	<u>Station</u>			
		<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
Alkalinity	ALK	x	x	x	x
Bacteriological					
Fecal Coliform	FC		x	x	x
Fecal Streptococci	FS		x	x	x
Total Coliform	TC		x	x	x
Biochemical Oxygen Demand	BOD	x	x	x	x
Chemical Oxygen Demand	COD	x	x	x	x
Cyanide	CN	x	x	x	x
Dissolved Oxygen	DO	x	x	x	x
Hydrogen Ion Concentration	pH	x	x	x	x
Metals		x	x	x	x
Nitrogen					
Ammonia	NH <sub>3</sub> -N	x	x	x	x
Nitrate	NO <sub>3</sub> -N	x	x	x	x

TABLE 4 (Cont.)  
ANALYSES PERFORMED ON SAMPLES FROM VARIOUS  
SAMPLING STATIONS

<u>Analysis</u>	<u>Abbreviation</u>	<u>Station</u>			
		1	2	3	4
Organic	Org-N	x	x	x	x
Oil & Grease	O & G	x	x	x	x
Pesticides		x		x	x
Phenols		x	x	x	x
Phosphate					
Ortho	O-PO <sub>4</sub>	x	x	x	x
Total	T-PO <sub>4</sub>	x	x	x	x
Solids					
Total Dissolved	TDS	x	x	x	x
Suspended	SS	x	x	x	x
Volatile Suspended	VSS	x	x	x	x
Settleable	STS	x	x	x	
Sulfates	SO <sub>4</sub>	x	x	x	x
Surfactants	MBAS	x	x	x	x
Spec. Cond.		x	x	x	x
Turbidity	TURB	x	x	x	x

5. Analytical Procedures Employed: Procedures utilized for the analysis of samples are listed in Table 5.

TABLE 5  
ANALYTICAL METHODS UTILIZED

<u>Analysis</u>	<u>Reference</u>	<u>Pages</u>
ALK	Methods for Chemical Analysis <sup>4</sup>	8 - 10
Bacteriological		
Fecal Coliform	Standard Methods <sup>5</sup>	684-685

TABLE 5 (Cont.)  
ANALYTICAL METHODS UTILIZED

<u>Analysis</u>	<u>Reference</u>	<u>Pages</u>
Fecal Streptococci	Standard Methods	690 - 691
Total Coliform	Standard Methods	679 - 683
BOD	Standard Methods	489 - 495
Chlorides	Methods for Chemical Analysis	31 - 33
COD	Standard Methods	495 - 499
CN	Standard Methods	404 - 406
Metals (Total)	Methods for Chemical Analysis	83 - 120
NH <sub>3</sub> -N	Methods for Chemical Analysis	141 - 149
NO <sub>3</sub> -N	Methods for Chemical Analysis	185 - 195
Org-N	Methods for Chemical Analysis	157 - 170
O & G	Standard Methods	409 - 410
Pesticides	Appendix IV	N/A
Phenols	Standard Methods	508 - 509
O-PO <sub>4</sub>	Methods for Chemical Analysis	239 - 245
T-PO <sub>4</sub>	Methods for Chemical Analysis	239 - 245
TDS	Standard Methods	535 - 536
SS	Standard Methods	537 - 538
VSS	Standard Methods	538
STS	Standard Methods	539
Specific Conductance	Standard Methods	323
MBAS	Standard Methods	340 - 342

## SECTION IV

### RESULTS AND DISCUSSION

#### 1. Flow Measurement:

a. Station 1: Since the total flow is split upstream from the Parshall flumes, the flow rate was measured at both flumes to determine if the flow was evenly split between the parallel sections of the treatment facility. These flow recordings demonstrated an even split in the flow and allowed the collection of flow proportional samples. The sweeping variations in flow depth, over short time periods however, caused by the cycling of the 2,500 gpm pump, precluded the use of the flow recordings for the determination of totalized flow. Figure 3 is a typical recording of the flow conditions existing at station 1 during the survey period.

b. Station 2: Head level recordings obtained through the use of the Stevens Type F recorder were changed to instantaneous flow rates using the Francis Formula for suppressed weirs:<sup>6</sup>

$$Q = 3.33 LH^{3/2} \quad (1)$$

The total daily flow was then obtained by calculating the mean of the instantaneous flow rates obtained from the flow chart at 15 minute intervals.

Figure 4 is a typical recording of head level at station 2 during the period of the survey.

c. Station 3: Head level recordings obtained through the use of the Stevens Type F recorder at station 3 were changed to instantaneous flow rates by use of equation 2.<sup>6</sup>

$$Q = 4 WH_a^{1.522} \quad (2)$$

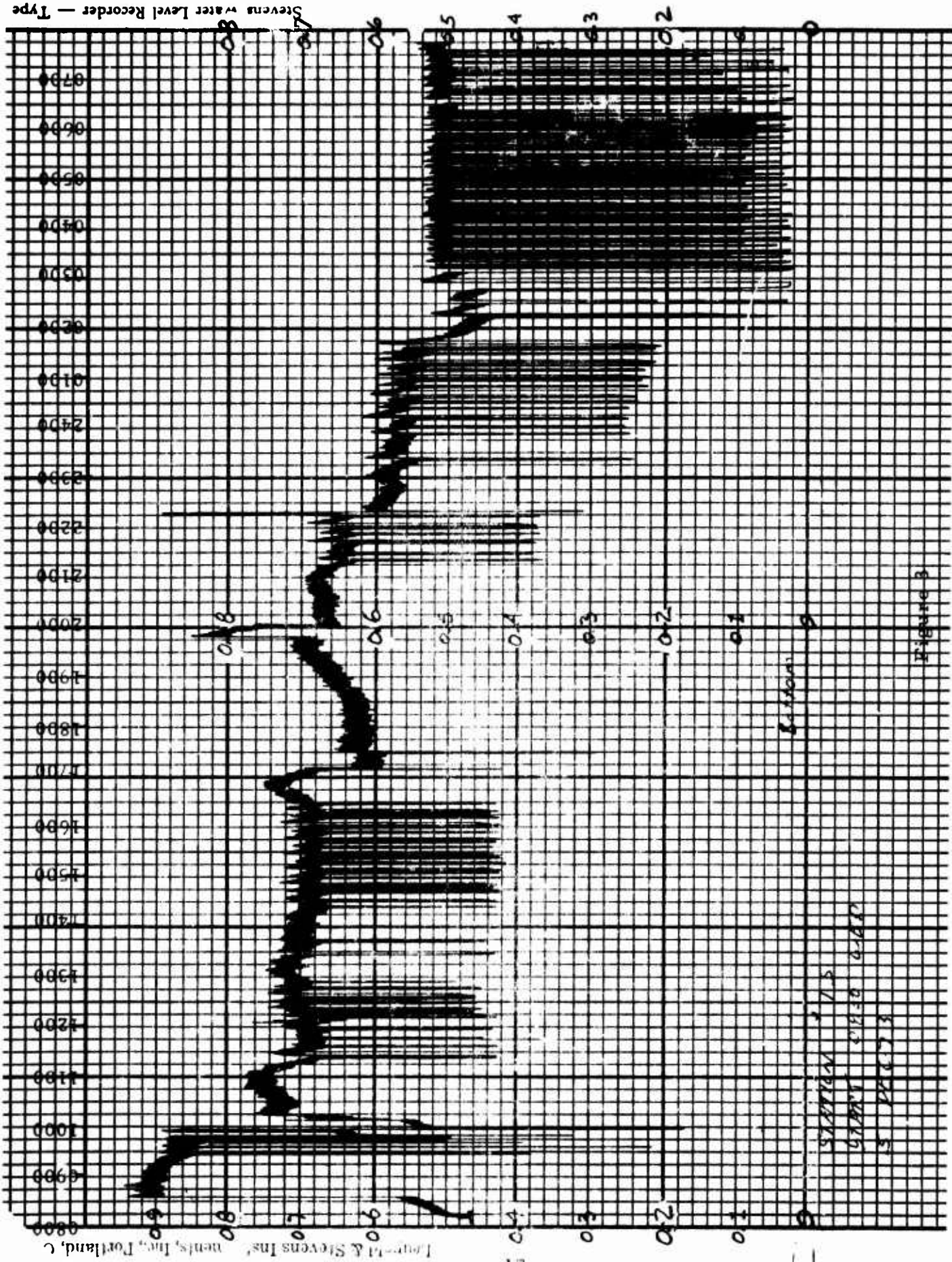
For a throat width W, of 1 foot this reduces to:

$$Q = 4H_a^{1.522} \quad (3)$$

Where  $H_a$  is the depth of the upstream head.

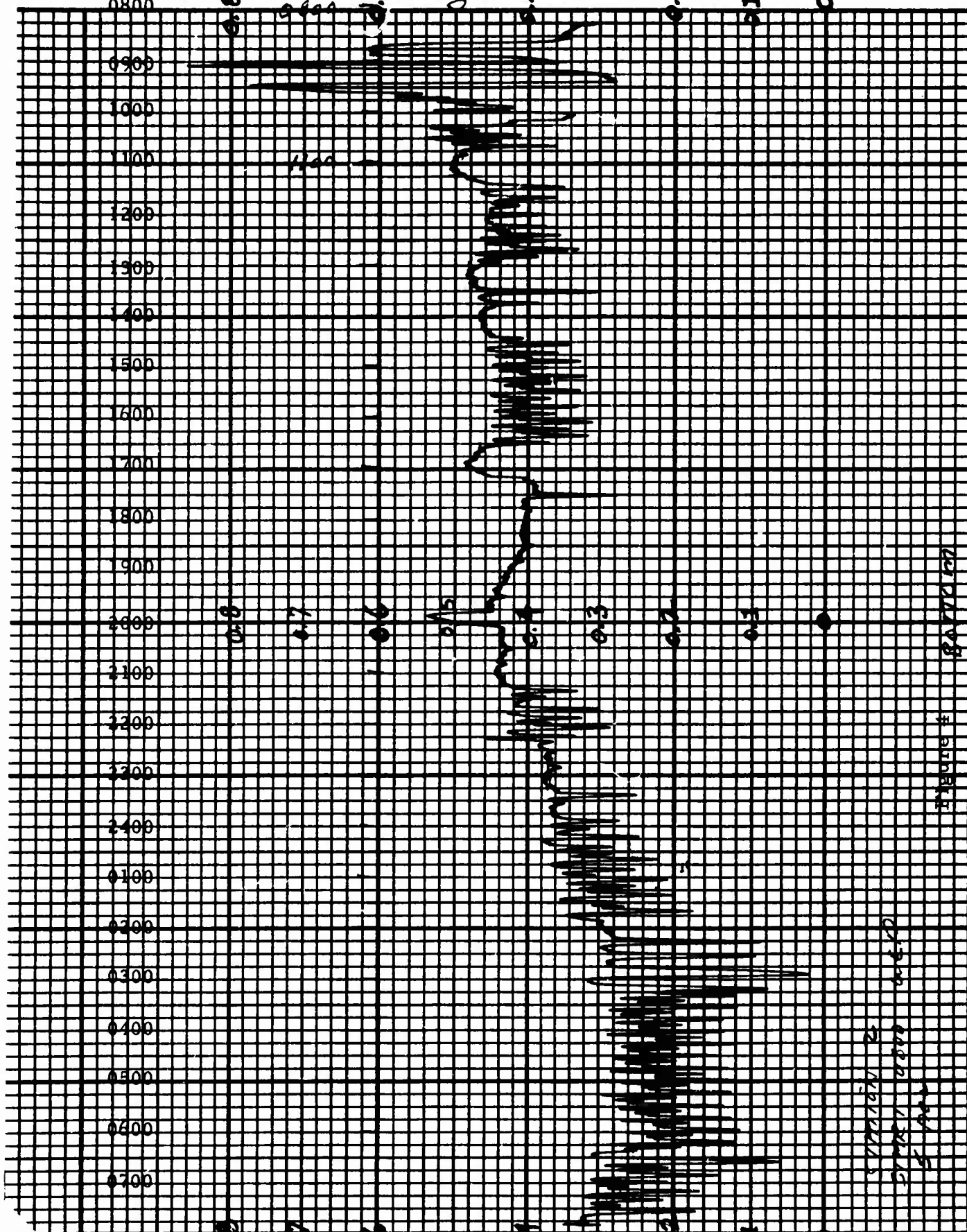
The total daily flow was then obtained by calculating the mean of the instantaneous flow rates obtained from the flow chart at one hour intervals. Figure 5 is a typical flow recording obtained from station 3 during the survey period. Table 6 presents the results of flow measurement for stations 1, 2 & 3, and the calculated total daily flow for stations 2 and 3 during the survey period.

Stevens water Level Recorder — Type



Typical Flow Recording - Station 1

Figure 3



Typical Flow Recording - Station 2

Stevens Water Level Record

HEAD

Chart F-1





Typical Flow Recording - Station 3

Figure 5

TABLE 6

RESULTS OF FLOW MEASUREMENT - STATIONS 1, 2 &amp; 3\*

Station 1	DATE												
	25	26	27	28	29	30	1	2	3	4	5	6	Mean
Max. Flow Rate	2.26	2.54	2.62	2.42	2.20	4.20	3.14	2.02	2.52	3.22	2.44	3.00	2.72
Min. Flow Rate**	<0.06	<0.06	<0.06	<0.06	<0.06	0.26	0.82	<0.06	<0.06	<0.06	<0.06	<0.06	<0.14
Station 2													
Total Flow	0.64	0.84	0.81	0.78	0.79	1.32	1.45	0.98	1.10	0.96	1.05	0.96	0.97
Max. Flow Rate	1.58	3.03	2.91	2.68	2.57	1.48	2.74	1.63	3.09	2.74	3.57	2.74	2.56
Min. Flow Rate	0.06	0.16	0.08	0.01	0.01	0.09	0.57	0.08	<0.01	<0.01	<0.01	0.01	<0.08
Station 3													
Total Flow	-	0.86	0.85	0.77	0.76	1.09	1.76	1.62	1.38	1.18	1.19	1.16	1.15
Max. Flow Rate	-	0.93	0.85	0.87	0.80	1.80	3.72	2.09	1.84	1.57	1.70	1.51	1.61
Min. Flow Rate	-	0.80	0.85	0.74	0.74	0.44	1.60	1.47	1.19	1.04	0.96	0.98	0.98

\* Flow Rates in MGD, Total Flow in MG

\*\* Per Flume

d. Station 4: The flow rate in the west drainage ditch is variable, depending primarily on the rate and frequency of precipitation in the Mather area. Results of Gurley meter ratings on various days are provided in Table 7. Rainfall data for the survey period is provided in Table 8.

TABLE 7  
RESULTS OF FLOW MEASUREMENT - STATION 4

<u>Date</u>	<u>Time</u>	<u>Flow Rate (MGD)</u>	<u>Gage Height (Ft)</u>
28 Nov	1130	0.48	.66
29 Nov	1130	0.05	0.56
30 Nov	1300	0.26	0.60
01 Dec	1100	1.37	2.14

TABLE 8  
MATHER AFB RAINFALL - 25 NOVEMBER THRU 6 DECEMBER 1973

<u>Date</u>	<u>2200 - 0400</u>	<u>TIME PERIOD</u>		
		<u>0400 - 1000</u>	<u>1000 - 1600</u>	<u>1600 - 2200</u>
25 Nov 73	0	Trace	0	0
26	0	0	0	0
27	0	0	0	0
28	0	0	0	0
29	0	0	0.02	0.08
30	0.01	Trace	0.09	0.48
1 Dec 73	0.51	0.38	0.02	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	0	0	0	0
6	0	0	0	0

## 2. Chemical Analyses:

a. Tables 9 through 12 present the results of chemical analyses performed on samples obtained from stations 1 through 4 during the survey period.

(1) The daily value entered in Tables 9 through 12 for temperature, DO and pH, represent the arithmetic mean of measurements obtained at various intervals during the 24 hour period.

(2) In Tables 9, 11 and 12, the "max pesticide" (maximum pesticide) concentration is obtained by summing the concentration of the 15 specific pesticides analyzed for, when the concentrations of those pesticides present below the quantitative limit, are assumed to be present at a concentration equal to the quantitative limit. The "min pesticide" (minimum pesticide) concentration is the sum of the concentration of the 15 specific pesticides analyzed for when the concentration of particular pesticides present below the quantitative limit is assumed to be zero. The 15 specific pesticides analyzed for are: Aldrin, DDD, DDE, Dieldrin, Endrin, Heptachlor, Heptachlor epoxide, Lindane, p,p - DDT, Diazinon, Malathion, Parathion, Methoxychlor, o,p - DDT and Chlordane.

b. Results of chemical analyses of samples obtained from the SAC aircraft corrosion control washrack (Facility 7035) on 28 November, following B-52 corrosion control activities are presented in Table 13.

Results of chemical analysis of samples obtained from the ATC aircraft washrack (Facility 4250), are presented in Table 14.

c. Results of chemical analyses of samples collected from the effluent sewer of the plating facility during the period 28 through 30 January 1974, are presented in Table 15. Plating shop personnel estimate the rinse water flow rate at 12 gallons per minute per rinse tank. Since there are 10 rinse tanks, all with constant flow rate (regardless of workload) the estimated total volume of rinse water discharged per eight hour work shift amounts to 57,600 gallons. During the period that samples were collected, shop personnel maintained a record of the dimensions and number of parts plated. This information was utilized to determine the surface area plated which is presented in Table 16. The comparatively large volume of rinse water utilized caused the concentration of some constituents to be below the laboratory's detectable limit. Table 17 summarizes the plating facility discharge characteristics in the format expressed in 40 CFR 413. The results presented in this table were obtained by calculating the total weight (mg) of a constituent discharged based on its concentration and a rinse water volume of 57,600 gallons per shift (Table 15), and dividing this weight by the corresponding area plated or surface treated, with copper, nickel, chromium and zinc (Table 16).

## 3. Bacteriological Analysis:

Results of bacteriological analysis are presented in Table 18. During

RESULTS OF CHEMICAL ANALYSES\* - STATION 1, 25 NOV - 6 DEC 1973

ANALYSIS	DATE													
	NOV							DEC						
	25	26	27	28	29	30	1	2	3	4	5	6	Mean	
Alkalinity	151	202	191	164	153	157	112	122	148	148	153	160	156	
BOD	160	144	156	184	117	122	91	116	117	282	135	124	146	
COD	343	400	442	352	322	356	193	202	325	658	371	322	357	
Cl <sup>-</sup>	19	19	20	19	20	20	15	16	-	92	22	25	26	
CN	0.13	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	
DO	-	-	2.8	4.4	2.5	7.7			4.4	4.4	3.0	3.2	4.1	
pH**	7.3	7.6	7.1	7.1	7.3	7.4	7.2	7.2	7.2	7.1	7.1	7.6	7.3	
MBAS	2.0	2.0	1.5	4.0	0.8	4.0	2.0	3.0	2.0	3.0	4.0	1.8	2.5	
METALS (total)														
Ag	0.08	0.13	0.05	0.12	0.08	0.11	0.04	< 0.03	0.06	0.06	0.06	0.03	<0.0	
As	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.0	
B	0.27	0.53	0.44	0.40	0.28	0.34	0.30	0.29	0.45	0.55	0.46	0.41	0.3	
Ba	<1.0	<1.0	<1.0	<1.0	-	-	-	-	-	-	-	-	<1.0	
Ca	15	19	18	16	13	14	13	12	14	10	13	12	14	
Cd	<0.01	0.03	0.03	0.02	0.02	0.01	<0.01	<0.01	0.03	0.01	<0.01	<0.01	<0.0	
Cr+6	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.0	
Cu	0.11	0.16	0.14	0.10	0.10	0.12	0.10	<0.10	<0.10	<0.10	0.10	<0.25	<0.1	
Fe	1.0	2.3	1.5	1.0	0.9	2.0	1.4	0.7	1.6	1.2	1.1	3.3	1.5	
Hg	0.002	0.011	0.007	0.003	0.003	<0.001	<0.001	<0.001	0.004	0.002	0.001	0.008	<0.0	
K	7.5	9.2	9.3	8.8	8.0	7.1	4.9	5.4	6.5	7.5	8.3	7.9	7.5	
Mg	6.0	6.6	6.2	6.1	5.7	5.5	6.1	5.9	5.8	5.1	5.5	5.4	5.8	
Mn	0.09	0.11	0.09	0.09	0.06	0.07	0.09	0.07	0.08	0.07	0.08	0.07	0.0	
Na	33	37	39	36	36	35	26	29	33	79	36	42	38	
Ni	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
Pb	0.06	0.20	0.18	0.08	0.06	0.20	0.02	0.01	0.06	0.09	0.06	0.08	0.0	
Se	<0.01	<0.01	<0.01		-	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.0	
Zn	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
Nitrogen														
NH <sub>3</sub> - N	16.5	28.0	30.0	20.5	16.5	19.0	9.0	5.0	18.0	20.0	18.0	18.0	18.0	
NO <sub>3</sub> - N	1.1	0.9	3.1	0.5	0.7	2.3	5.5	3.6	1.1	0.5	0.8	0.7	1.0	
Org - N	22	39	43	25	27	22	21	8.0	24	28	26	27	26	
O & G	21	20	33	18	20	18	6	15	10	13	45	18	20	

TABLE 7 (Cont.)

ANALYSIS	DATE													
	NOV							DEC						
	25	26	27	28	29	30	1	2	3	4	5	6	Mean	
Pesticides ***														
Max			100			20			80			67	67	
Min			0			0			60			47	37	
Phenol	0.09	0.09	0.32	0.20	0.35	0.75	0.36	0.02	0.17	0.72	1.70	0.04	0.40	
Phosphate														
O-PO <sub>4</sub>	15	16	17	16	16	15	8	10	12	11	15	18	14	
T-PO <sub>4</sub>	29	32	38	25	30	30	18	22	28	27	31	37	29	
Solids														
TDS	418	360	374	392	492	501	453	610	334	495	- -	486	447	
SS	133	255	224	119	110	150	- -	61	155	327	273	116	175	
VSS ***	22	77	61	25	17	33	50	10	41	48	28	19	36	
STS ***	6.4	5.2	8.8	6.4	4.9	6.5	2.6	4.0	3.9	3.8	5.8	5.6	5.3	
Sulfates	26	49	31	25	26	25	20	21	33	25	22	15	26	
Spec. Cond. ****	405	507	486	450	417	403	300	335	397	632	414	432	432	
Turb. **	55	85	80	65	70	60	47	45	80	150	80	75	74	
* Mg/l unless otherwise noted														
** units														
*** nanograms/liter														
**** Ml/l														
***** $\mu$ mho														

RESULTS OF CHEMICAL ANALYSES\* - STATION 2, 25 NOV - 6 DEC 1973

ANALYSIS	DATE											
	NOV						DEC					
	25	26	27	28	29	30	1	2	3	4	5	6
Alkalinity	134	180	175	144	144	131	97	106	144	133	144	160
BOD	30	53	46	46	26	24	21	34	35	47	24	31
COD	100	78	159	132	105	154	88	81	95	146	121	165
Cl <sup>-</sup>	22	23	22	22	23	20	18	18	-	95	30	25
CN	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
DO	-	-	5.1	5.5	4.6	6.8			6.8	4.7	5.0	4.1
pH**	7.5	7.6	7.5	7.4	7.6	7.4	7.2	7.3	7.5	7.5	7.5	7.5
MBAS	1.0	1.5	2.0	1.5	1.0	2.0	1.5	1.0	1.5	2.0	1.5	1.8
METALS (total)												
Ag	<0.03	0.06	0.08	0.07	0.05	0.05	0.03	<0.03	0.05	0.03	0.04	0.05
As	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
B	0.24	0.34	0.34	0.33	0.21	0.31	0.24	0.27	0.45	0.40	0.40	0.46
Ba	<1.0	<1.0	<1.0	<1.0	-	-	-	-	-	-	-	-
Ca	14	14	16	14	12	12	14	12	12	11	10	13
Cd	<0.01	<0.01	0.02	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
Cr+6	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cu	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	2.0	0.1	<0.1	<0.1	<0.1
Fe	<0.45	0.75	0.90	0.75	0.36	1.20	1.20	0.69	0.82	0.83	0.61	2.30
Hg	0.006	0.008	0.006	0.004	<0.001	<0.001	<0.001	<0.001	0.003	0.008	0.012	0.003
K	7.8	8.3	9.0	8.9	8.5	6.5	4.7	5.3	6.9	7.9	7.2	7.4
Mg	5.9	5.8	6.1	6.1	5.5	5.2	6.0	6.1	5.8	6.0	5.0	5.9
Mn	0.08	0.07	0.08	0.09	0.05	0.06	0.08	0.06	0.08	0.06	0.07	0.09
Na	34	36	37	38	37	33	27	28	32	85	35	48
Ni	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Pb	0.03	0.05	0.06	0.05	0.03	0.07	0.02	0.02	0.03	0.01	0.01	<0.01
Se	<0.01	<0.01	<0.01	-	-	-	-	-	<0.01	<0.01	<0.01	<0.01
Zn	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Nitrogen												
NH <sub>3</sub> - N	13.5	25.5	21.1	14.0	17.0	16.0	7.5	4.0	16.0	17.0	16.0	15.0
NO <sub>3</sub> - N	2.6	1.6	1.7	1.3	1.2	4.6	6.8	5.8	1.3	1.1	1.1	0.9
Org - N	15	34	21	19	19	21	24	6	19	20	20	21
O & G	15	5	8	2	8	2	-	4	5	4	2	3





RESULTS OF CHEMICAL ANALYSES\* - STATION 3, 25 NOV - 6 DEC 1973

ANALYSIS	DATE											
	NOV						DEC					
	25	26	27	28	29	30	1	2	3	4	5	6
Alkalinity	64	64	62	64	65	66	63	67	71	74	77	79
BOD	18	11	33	16	6	14	16	20	13	16	4	12
COD	72	48	76	52	68	89	36	57	70	67	60	77
Cl-	20	21	18	20	21	22	19	19	-	22	21	22
CN	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
DO	-	-	12.2	14.8	11.4	10.5		11.2	10.2	8.7	9.0	10.2
pH**	7.8	7.7	7.8	7.7	7.2	7.4	7.6	7.6	7.6	7.6	7.7	7.7
MBAS	0.3	0.2	<0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.3
METALS (total)												
Ag	<0.03	<0.03	0.03	<0.03	0.03	0.03	0.03	<0.03	<0.03	<0.03	<0.03	<0.03
As	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
B	0.26	0.31	0.29	0.28	0.28	0.28	0.24	0.35	0.36	0.35	0.38	0.40
Ba	<1.0	<1.0	<1.0	<1.0	-	-	-	-	-	-	-	-
Ca	14	14	14	15	14	13	14	11	10	12	12	9
Cd	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cr+6	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cu	<0.10	<0.10	0.19	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.11
Fe	0.45	0.34	0.28	0.33	0.29	0.48	0.51	1.60	0.21	0.72	0.24	0.63
Hg	0.002	0.001	0.003	0.003	<0.001	<0.001	0.002	0.003	0.001	0.009	0.009	0.003
K	7.5	7.2	7.6	7.6	7.2	6.7	6.6	6.7	6.1	6.4	6.3	6.3
Mg	5.5	5.3	5.7	5.5	5.5	5.4	5.1	4.8	4.8	4.8	4.9	5.0
Mn	0.07	0.04	0.05	0.07	0.04	0.05	0.05	0.05	0.04	0.04	0.04	0.03
Na	35	33	34	35	34	33	31	31	30	32	32	33
Ni	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Pb	0.01	0.01	0.01	0.01	0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Se	<0.01	<0.01	<0.01	-	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01
Zn	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Nitrogen												
NH <sub>3</sub> - N	0.7	0.5	0.5	0.5	0.7	1.2	1.4	1.8	2.6	2.9	3.0	3.2
NO <sub>3</sub> - N	6.6	7.7	6.4	6.2	4.2	26.0	24.0	5.4	4.8	4.4	5.2	4.0
Org - N	5.5	5.0	5.1	4.7	5.4	5.9	16	5.8	6.2	6.7	7.1	7.8
O & G	2	2	2	<2	<2	<2	<2	<2	<2	<2	<2	<2

TABLE 11 (Cont.)

[illegible]

# RESULTS OF CHEMICAL ANALYSES\* - STATION 4, 25 NOV - 6 DEC 1973

ANALYSIS	DATE													
	NOV							DEC						
	25	26	27	28	29	30	1	2	3	4	5	6	Mean	
Alkalinity	61	54	67	80	67	39	18	34	39	49	54	82	54	
BOD	93	2	34	36	16	16	4	5	4	4	14	2	19	
COD	199	40	104	64	85	81	36	20	25	25	20	20	60	
Cl <sup>-</sup>	6	8	8	8	7	4	< 2	< 2	-	5	23	43	< 11	
CN	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	
DO	-	-	6.0	6.3	6.1	10.2		10.4	8.5	9.1	10.0	11.2	8.6	
pH**	7.0	7.2	7.2	7.3	7.3	6.6	6.6	7.2	7.2	7.1	7.3	7.3	7.1	
MBAS	1.5	1.5	1.0	3.0	0.8	1.5	0.3	0.2	0.3	0.4	0.3	< 0.2	< 0.9	
METALS (total)														
Ag	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	
As	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	
B	0.19	0.23	0.26	0.22	0.18	0.23	0.25	0.18	0.26	0.22	0.30	0.13	0.2	
Ba	< 1.0	< 1.0	< 1.0	< 1.0	-	-	-	-	-	-	-	-	< 1.0	
Ca	13	12	13	15	11	7	6	8	7	9	9	26	11	
Cd	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	
Cr+6	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	
Cu	0.18	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.1	
Fe	1.3	3.0	1.4	1.7	1.4	2.5	2.9	2.1	1.2	1.3	0.9	1.5	1.8	
Hg	0.002	0.002	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	0.003	0.007	0.006	0.002	< 0.00	
K	2.8	2.8	3.4	3.8	7.8	2.4	1.7	1.8	1.5	1.7	2.4	4.0	3.0	
Mg	3.7	3.8	4.0	4.6	3.4	2.2	2.0	2.8	2.8	3.5	4.4	8.4	3.8	
Mn	0.11	0.12	0.06	0.16	0.13	0.27	0.06	0.04	0.04	< 0.04	< 0.04	0.08	< 0.1	
Na	11	10	14	17	14	8	4	5	6	8	14	28	12	
Ni	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	
Pb	0.03	0.04	0.03	0.03	0.03	0.02	0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.03	< 0.0	
Se	< 0.01	< 0.01	< 0.01	< 0.01	-	-	-	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.0	
Zn	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	
Nitrogen														
NH <sub>3</sub> - N	1.8	1.2	1.9	2.0	8.5	2.2	0.6	0.7	0.6	0.8	1.7	1.0	1.9	
NO <sub>3</sub> - N	1.3	1.5	1.1	0.9	0.9	1.7	4.0	1.9	2.4	2.3	2.3	2.0	1.8	
Org - N	2.8	2.9	3.2	3.9	20.0	3.4	1.4	1.5	1.4	1.7	2.7	2.2	3.9	
O & G	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 3	

TABLE 12 (Cont.)

ANALYSIS	DATE											
	NOV						DEC					
	25	26	27	28	29	30	1	2	3	4	5	6
Pesticides ***												
Max			0			43			30			20
Min			0			33			0			0
Phenol	0.26	0.02	0.01	0.10	0.04	0.01	0.04	0.01	0.01	<0.01	<0.01	<0.01
Phosphate												
O-PO <sub>4</sub>	2.1	2.0	4.7	4.7	5.3	3.0	0.8	0.7	0.6	0.8	2.4	1.0
T-PO <sub>4</sub>	3.3	2.6	4.9	6.0	5.5	4.0	0.9	0.9	1.0	1.2	3.0	1.2
Solids												
TDS	245	240	264	247	302	305	262	319	149	297	250	290
SS	20	63	7	6	3	17	-	8	11	5	5	1
VSS	10	53	6	5	0	11	7	7	5	5	5	2
STS****												
Sulfates	11	10	9	6	9	8	17	14	13	14	9	9
Spec. Cond. *****	165	149	186	203	177	108	65	110	130	152	220	253
Turb. **	15	25	12	14	15	38	55	40	25	16	17	12
* Mg/l unless otherwise noted												
** units												
*** nanograms/liter												
**** ml/l												
***** $\mu$ mho												

TABLE 13

RESULTS OF CHEMICAL ANALYSIS  
SAC AIRCRAFT WASHRACK EFFLUENT  
28 NOV 73 (mg/l unless noted)

CONSTITUENT	CONCENTRATION	CONSTITUENT	CONCENTRATION
ALK as CaCO <sub>3</sub>	71	Nitrogen	
BOD	530	NH <sub>3</sub> - N	1.8
COD	2220	NO <sub>3</sub> - N	7.6
Cl	3.3	Org - N	48.0
CN	<0.01	O & G	<2
pH*	7.0	Phenol	21
MBAS	80	Phosphate	
Metals (total)		O-PO <sub>4</sub>	2
Ag	0.04	T-PO <sub>4</sub>	4
B	1.4		
Ca	9.2		
Cd	0.10		
Cr <sup>+6</sup>	<0.01		
Cu	0.45	Sulfates	16
Fe	0.41	Spec. Cond. **	245
Hg	0.001	Turbidity*	52
K	2.4		
Mg	4.1		
Mn	<0.04		
Na	33		
Ni	<0.50		
Pb	0.20		
Se	<0.01		
Zn	<0.50		
* units			
** $\mu$ mho			

TABLE 14

RESULTS OF CHEMICAL ANALYSIS  
ATC AIRCRAFT WASHRACK EFFLUENT  
30 NOV, 4 DEC & 6 DEC 1973 (mg/l unless noted)

CONSTITUENT	CONCENTRATION			
	30 NOV	4 DEC*	4 DEC**	6 DEC
ALK as CaCO <sub>3</sub>	143	145	125	134
BOD	1140	- -	2460	1290
COD	2380	5062	3833	2661
Cl	6.0	- -	9.8	9.6
CN	- -	<0.01	<0.01	<0.01
pH***	7.4	7.8	7.5	8.2
MBAS	150	400	80	100
METALS (total)				
Ag	<0.03	<0.03	<0.03	<0.03
B	0.37	0.48	0.22	0.16
Ca	16	18	15	16
Cd	0.03	0.05	0.06	0.10
Cr <sup>+6</sup>	<0.01	<0.01	<0.01	<0.01
Cu	0.10	0.18	<0.10	<0.10
Fe	2.1	2.8	2.6	1.6
Hg	<0.001	- -	0.10	0.001
K	8.9	10.0	9.6	12.0
Mg	3.3	3.7	3.9	4.0
Mn	0.14	0.30	0.23	0.14
Na	42	79	47	72
Ni	<0.50	<0.50	<0.50	<0.50
Pb	1.10	0.90	0.08	1.00
Se	- -	<0.01	<0.01	<0.01
Zn	<0.50	<0.50	<0.50	<0.50
Nitrogen				
NH <sub>3</sub> -N	1.2	2.2	1.4	1.0
NO <sub>3</sub> -N	3.2	3.4	4.8	5.2
Org-N	2.6	4.0	3.5	3.0
O & G	15	6	16	<2
Phenol	2.22	8.43	180	135
Phosphate				
O-PO <sub>4</sub>	9.0	6.5	7.9	8.0
T-PO <sub>4</sub>	51	49	33	60

TABLE 14 (Cont.)

CONSTITUENT	CONCENTRATION			
	30 NOV	4 DEC*	4 DEC**	6 DEC
Solids				
TDS	. .	113	534	791
SS	. .	31	415	41
VSS	. .	5	5	11
Sulfates	17	40	20	30
Spec. Cond. ****	313	375	319	327
Turbidity***	110	48	97	125

\* 0100-0400

\*\* 1200-1500 following T-29 Paint Stripping Operation

\*\*\* units

\*\*\*\*  $\mu$ mhos

RESULTS OF CHEMICAL ANALYSIS - PLATING FACILITY EFFLUENT  
28 - 30 JAN 1974

CONSTITUENT	UNITS	DATE					
		28 JAN		29 JAN		30 JAN	
		Day Shift	Swing Shift	Day Shift	Swing Shift	Day Shift	Swing Shift
Cadmium	mg/l Mg*	<.01** <2180	0.01 2180	0.03 6541	0.03 6541	0.05 10902	0.03 6541
Chromium (tot)	Mg/l Mg	0.05 10902	0.40 87216	0.35 76313	0.35 76313	0.09 19624	0.40 87216
Copper	Mg/l Mg	6.5 1.42x10 <sup>6</sup>	1.5 327060	<0.10 <21804	<0.10 <21804	<0.10 <21804	<0.10 <21804
Lead	Mg/l Mg	0.13 28345	0.05 10902	0.04 8722	0.08 17443	0.04 8722	0.04 8722
Silver	Mg/l Mg	<0.03 <6541	<0.03 <6541	<0.03 <6541	<0.03 <6541	<0.03 <6541	<0.03 <6541
Zinc	Mg/l Mg	3.6 784942	<0.5 <109020	<0.5 <109020	<0.5 <109020	<0.5 <109020	<0.5 <109020
Nickel	Mg/l Mg	<0.5 <109020	<0.5 <109020	<0.5 <109020	<0.5 <109020	<0.5 <109020	<0.5 <109020

\* Weight of discharge, milligrams, per shift calculated as follows:  

$$(\text{Conc mg/l}) \left( \frac{\text{Total Flow, Gallons}}{\text{Shift}} \right) \left( \frac{3.75 \text{ Liter}}{\text{gallon}} \right) = \text{mg/shift}$$

\*\* All "<" indicate Laboratory Lower detectability Limit



TABLE 16

PLATING FACILITY PRODUCTION (Sq. Meters)  
28 - 30 JAN 1974

OPERATION	DATE					
	28 JAN		29 JAN		30 JAN	
	Day Shift	Swing Shift	Day Shift	Swing Shift	Day Shift	Swing Shift
1. Cadmium Plating	0.01	10.09	2.34	2.30	0.36	0.11
2. Alum Chrom coat	12.60	0.18	5.40	0	3.20	0.05
3. Alum Anodizing	0	4.20	0	4.20	0	0
4. Copper Plating	0	0	0	0	0.18	0
5. Magnesium Surface treatment	0	0	0	0	0	0
Total of 2-5 above*	12.60	4.38	5.40	4.20	3.38	0.05

\* This value used in preparation of Table 17

TABLE 17

PLATING FACILITY EFFLUENT CHARACTERISTICS (Mg/m<sup>2</sup>\*)

CONSTITUENT	DATE					
	28 JAN		29 JAN		30 JAN	
	Day Shift	Swing Shift	Day Shift	Swing Shift	Day Shift	Swing Shift
Copper	112,700	74,700	<4040	<5190	<6450	<436,000
Nickel	<8,680	<24,900	<20,200	<26,000	<32,300	<2.18x10 <sup>6</sup>
Chromium (total)	865	19,900	14,100	18,200	5800	1.74x10 <sup>6</sup>
Zinc	62,300	<24,900	<20,200	<26,000	<32,300	<2.18x10 <sup>6</sup>

\* Milligrams per square meter of surface area treated (excluding cadmium plating)

\*\* All < signs indicate the concentration on which this figure is based is lower than the laboratory's quantitative detection limit.

TABLE 18

## RESULTS OF BACTERIOLOGICAL ANALYSES

ANALYSIS	DATE												geometric mean
	25	26	27	28	29	30	1	2	3	4	5	6	
STATION 2													
Fecal Strep (FS)	190	800	TNTC	6	TNTC	1400	7500	3300	31,000	9500	200	8500	
Fecal Coliform (FC)			TNTC	34	TNTC	540	114	30	65,000	5300	500	TNTC	
TOTAL Coliform (TC)	40x10 <sup>3</sup>	TNTC	1x10 <sup>6</sup>	360	TNTC	22x10 <sup>4</sup>	24x10 <sup>3</sup>	6400	4.3x10 <sup>6</sup>	1x10 <sup>6</sup>	7.3x10 <sup>4</sup>	3.8x10 <sup>6</sup>	
STATION 3													
Fecal Strep (FS)			3	8	3	48	86	44	21	19	0	9	
Fecal Coliform (FC)			10	20	15	61	80	48	34	9	8	206	28.5
Total Coliform (TC)	218	60	23	37	130	TNTC	250	220	110	110	120	125	
FA/FS Ratio			3.3	2.5	5.0	1.3	0.9	1.1	1.6	0.5		22.9	
STATION 4													
Fecal Strep (FS)	TNTC	40	18	110	1000	TNTC	670	260	67	46	13	44	
Fecal Coliform (FC)			50	820	TNTC	TNTC	TNTC	TNTC	TNTC	60	100	2000	
Total Coliform (TC)			8600	2200	TNTC	TNTC	5.8x10 <sup>4</sup>	1000		1000	990	71	
FC/FS Ratio			2.8	7.5						1.3	7.7	45.4	

the survey period the high concentrations of total and fecal coliform and fecal strep found at station 4 were unexpected. Analysis of fecal coliform: fecal strep ratios indicated that the west ditch was contaminated with fecal wastes of human origin. Additional samples were collected further upstream with similar results, which led to a visual inspection of the entire ditch. This inspection revealed gross pollution, with septic conditions and large masses of bacterial growths at the point that the west ditch emerges from an underground culvert across from Facility 3260. Further investigation revealed that the sewage lift station (Facility 3280) serving a sewer line that crosses perpendicular, and at an elevation well below the level of the ditch, was completely inoperative and that the sewer line was surcharged. Inspection of MH number 53, located northwest of the drainage ditch revealed the presence of a raw sewage by-pass line leading directly to the west ditch. The surcharged sewer was found to be discharging to the by-pass line and subsequently into the west drainage ditch.

#### **4. Treatment Facility Operation:**

Although treatment facility operators and engineering personnel are currently working to improve this facility, it shows the signs of past neglect. Additionally, past administrative and personnel difficulties have in some cases eroded operator's morale. This situation reduces the communication between engineering personnel and the treatment facility operators, which in turn, prevents a timely and coordinated solution to problems effecting the treatment facility and its equipment. During the survey period operators did not have available a record of installed plant equipment, and corresponding individual operating instructions or maintenance schedules. Operators were attempting to gather this information, but much of the equipment at this facility is so old that manufacturers do not have service bulletins available. Timely equipment maintenance is also hampered by the lack of equipment elapsed time meters, and the lack of accurate as-built drawings of the entire facility. Specific treatment facility equipment requiring repair at the time of the survey included:

- a. Influent lift station pump number 3.
- b. Sludge scraper arms of all clarifiers.
- c. Digester heat exchange boiler.
- d. Digester waste gas burner.
- e. Effluent flow rate recorder and totalizer.
- f. Sludge drying beds.
- g. Chlorine contact chamber.

The sewage treatment facility laboratory lacks much equipment necessary for good treatment control and effluent quality monitoring and documentation.

Specific equipment needed for the treatment facility laboratory is listed in Section V, Recommendations.

The treatment facility laboratory itself is barely adequate. The area provided is too small and the electrical wiring is inadequate to allow simultaneous use of laboratory equipment.

#### 5. Treatment Facility Performance:

a. Actual Treatment Facility Performance: Table 19, depicts treatment facility performance in terms of percent reduction in BOD, COD, and SS, for the survey period.

b. Theoretical Trickling Filter Efficiency: There are a number of design equations that can be employed to predict the expected treatment efficiency, in terms of BOD removal, of trickling filter treatment facilities. One of the most conservative of these is the National Research Council (NRC) formula, which is given by equation:

$$E = \frac{100}{1 + 0.0085 \left( \frac{W}{VF} \right)^{1/2}} \quad (4)$$

Where:

E = Percent BOD removal efficiency through the filter and final clarifier.

W = BOD loading (lbs/day) to the filter not including recycle.

V = Volume of the particular filter, acre · ft.

F = Recirculation factor as given below:

$$F = \frac{(1 + R)}{(1 + 0.1R)^2}$$

R = Recirculation ratio, which equals the recirculated flow divided by the plant influent flow.

Using this equation, Mather's treatment facility's expected first stage BOD removal efficiency (not including the polishing lagoon) is calculated to 70%. See Appendix V for calculation and assumptions.

c. Theoretical Polishing Lagoon Efficiency: Design equations used to accurately predict the BOD removal efficiency of polishing lagoons require more information than could be obtained during the survey period.

BOD STATION	DATE												Mean*
	NOV						DEC						
	25	26	27	28	29	30	1	2	3	4	5	6	
1 to 2	81	63	70	75	78	80	77	70	70	83	82	75	76
2 to 3	40	79	28	65	77	42	24	41	63	66	83	61	57
1 to 3	89	92	79	91	95	88	82	82	89	94	97	90	90
COD													
1 to 2	71	81	64	63	67	57	54	60	71	78	67	49	67
2 to 3	28	38	52	61	35	42	59	30	26	54	50	53	46
1 to 3	79	88	83	85	79	75	81	72	78	90	84	76	82
SS													
1 to 2	78	87	80	74	79	83	--	52	97	88	91	75	84
2 to 3	77** (7)	6	73	6	(39)	(40)	--	(3)	(520)	28	12	10	0
1 to 3	77	87	95	76	71	77	--	51	80	91	92	78	84

\*\*\* Numbers in parantheses indicate % increase rather than % removal.

Table 12-9, Page 553 of reference 8 can be used however, to predict the range of effluent constituents expected, based on influent characteristics and pond operating conditions (aerobic, aerobic-anaerobic, anaerobic, etc.).

Based on an influent BOD of 35 mg/l, the polishing lagoon effluent is expected to have a SS concentration of from 21 to 53 mg/l, and an effluent BOD concentration of from 7 to 20 mg/l. The corresponding predicted BOD removal efficiency range is from 43 to 80 percent. Based on an average lagoon influent SS concentration of 28 mg/l, the expected SS removal efficiency ranges from -89 to 25 percent. It should be noted that a minus 89 percent removal corresponds to an expected increase in the pond SS due to the growth of algae in the ponds.

d. Theoretical Overall Treatment Facility Efficiency: The treatment facility's theoretical efficiency for BOD and SS is summarized in Table 20.

TABLE 20

THEORETICAL TREATMENT FACILITY EFFICIENCY (% REMOVAL)

Unit	Theoretical Efficiency	
	BOD	SS
(1) Primary Clarifier	30 <sup>(9)</sup>	50 <sup>(9)</sup>
(2) Trickling Filter & Final Clarifier	70	*
(3) Secondary Treatment (consisting of 1 & 2 above)	79	*
(4) Polishing Lagoon	43 to 80	-81 to 38**
(5) Total Treatment Facility	88 to 96	70 to 88

\* Can not be theoretically determined.

\*\* Based on an influent BOD concentration of 35 mg/l and influent SS concentration of 29 mg/l.

SECTION V

CONCLUSIONS

1. During the survey period, the average total daily flow as measured at the effluent weir of the chlorine contact chamber was 0.97 MG. The average total daily flow as measured at the Parshall flume in the discharge channel from the polishing lagoons was 1.15 MG. The actual total daily flow discharged from the treatment facility during the survey period should be taken as 1.15 MG for two reasons:

a. The Parshall flume is of standard dimensions while the weir installation at the chlorine contact chamber does not exactly meet all of

the criteria of a standard rectangular weir as stated on page 13 of reference 6.

b. The total flow was obtained by a manual integration of flow rate obtained from the Stephens Type F head level recorders. Since the flow rate from the polishing lagoons was almost constant, this integration was considerably more accurate than the integration obtained from the flow rate chart at Station 2.

2. California Regional Water Quality Control Board, Central Valley Region, Resolutions 117 (20 February 1952), and 61-150 (14 December 1961), pertaining to Mather's domestic and industrial discharges to Morrison Creek, are not strictly applicable to existing conditions as almost all wastes are now treated at the domestic wastewater treatment facility. Assuming however, that Morrison Creek water quality conditions required to protect downstream uses, as stated in resolution 61-150, are still applicable, these resolutions can be used as a guide to determine if Mather's wastewater discharges are currently meeting discharge requirements.

3. Resolution number 117 contains three specific requirements that govern the nature of the discharge from Mather's wastewater treatment facility. These requirements are:

- a. Adequate disinfection.
- b. 80% reduction of influent BOD.
- c. A maximum settleable solids concentration of 0.5 ml/liter.

A review of the results previously presented reveals that Mather's discharge met or exceeded these specific requirements during the survey period. This resolution further requires that "neither the plant nor the disposal shall cause a nuisance or a pollution in Morrison Creek." Since the terms "nuisance" and "pollution" are not defined, this requirement is open to differing interpretations, however, the 40 day detention period in the polishing lagoons provide a well oxidized effluent that supports a diversified array of aquatic life and presents no odor problems. On this basis it is concluded that the discharge does not constitute a nuisance or pollution of Morrison Creek.

4. Resolution 61-150 pertains to the water quality to be maintained in Morrison Creek downstream from its confluence with Mather's west drainage ditch. During the survey period, as during the summer dry weather period, Morrison Creek originates as the discharge from Mather's polishing lagoons. The final discharge leaving the base under this condition, is composed of the combined flow of polishing pond effluent and the flow from the west drainage ditch. These two streams were sampled and analyzed during the survey period. A review of the results of chemical analyses reveals that the quality of both streams, and therefore the combined



streams, met or exceeded the discharge resolution requirements during the survey period. It should be noted however, that laboratory analysis for zinc concentrations were constrained by a laboratory lower detection limit of 0.5 mg/l, whereas the discharge resolution requires analysis to 0.3 mg/l. Based on the overall chemical quality of the waste stream however, we are confident that the discharge contains less than 0.3 mg/l of zinc.

5. Based on a conservative design equation the first stage of the treatment facility is capable of providing 79% removal of influent BOD. The entire treatment facility (first stage and polishing lagoon) is capable of BOD reductions in the range of 88 to 96%, and suspended solids reductions of from 70 to 88%. Actual treatment facility performance during the survey period revealed a first stage BOD removal efficiency of 76%, and an overall (first stage and polishing lagoon) removal efficiency of 90% for BOD and 84% for SS.

6. The Environmental Protection Agency (EPA) has defined the level of effluent quality attainable through the application of "secondary" or biological treatment. This information is provided in Appendix VI. In essence, the EPA defines "secondary treatment" in terms of BOD and SS removal efficiency, effluent fecal coliform bacteria concentration and effluent pH range. During the survey period the first stage of the treatment facility did not provide sufficient reduction in BOD, SS, or fecal coliform organisms to provide "secondary treatment" according to EPA standards. During the survey period the overall treatment facility performance however (first stage and polishing lagoons), approached "secondary treatment" according to EPA standards. Table 21 depicts treatment facility performance versus EPA standards for secondary treatment.

TABLE 21

TREATMENT FACILITY PERFORMANCE VERSUS EPA REQUIREMENTS  
FOR "SECONDARY TREATMENT"

Constituent	Performance		EPA Requirements
	Stage I	Overall (Stage I & Polishing Lagoon)	
BOD	76%	90%	85%
SS	84%	84%	85%
Fecal Coliform	30-TNTC*	29*	200/100 ml*
pH	7.5	7.6	6.0 - 9.0

\* Colonies / 100 ml

The theoretical performance calculated for the first stage of this facility (Table 20), is based on the most conservative design equation currently in use, and assumes no recirculation other than that provided by the secondary sludge return pumps. This is the absolute minimum efficiency that this facility should provide. Greater efficiency is possible with improved equipment maintenance and operational control.

7. There is a lack of effective communication between treatment facility operators and the engineering staff.

8. The existing treatment facility laboratory does not have sufficient modern equipment to enable the operators to perform operational control, and treatment performance testing in an efficient manner.

9. Since the decision has been made to join the County Regional Wastewater Treatment System in the near future, the current MCP project to add to and alter the wastewater treatment facility is not applicable as planned. The existing facility however, does require some equipment replacement, and repair to remain operational until the regional system is on-line. Required actions are presented in Section VI, Recommendations.

10. The inadvertant discharge of raw wastewater to the west ditch, caused by the inoperative lift station, existed for at least one full week (and probably much longer) prior to discovery by survey personnel, and indicates an ineffective program of lift station inspection and maintenance.

11. The effluent discharge from the metal cleaning and plating facility, will not be subject to the limitations of Section 413, 12(a) of 40 CFR 413, since production is considerably less than 33 square meters per hour. This facility will however, have to meet the effluent standards established by the Regional EPA office as part of the NPDES program. Flow measurement from this facility is currently extremely difficult since the sewer line is inaccessible. Effluent quality monitoring is also extremely difficult, because the large volume of rinse water currently utilized causes the concentration of constituents to fall below laboratory detectable limits.

12. The overflow lines from the oil separators at facilities 3990, 4770, 4250, 7022 and 7035, and the underdrains from the gravity oil separators at facilities 2898, 2990, 3320 and 7009, that discharge to the storm drainage system are potential sources of uncontrolled water pollution, which could result in violation of existing discharge standards.

13. Records of treatment facility equipment specifications, preventive maintenance schedules and plant as-built drawings are incomplete.

## SECTION VI

### RECOMMENDATIONS

1. The entire treatment facility should be operated with the objective of providing an effluent that meets the EPA's standards for secondary treatment (Appendix VI). Since the first stage of the system is theoretically incapable of providing an 85% BOD reduction, the polishing lagoons must be employed to increase BOD removal efficiency. It should be noted however, that the reduction of BOD obtained in the polishing lagoons may be accompanied by an increase in suspended solids concentration due to the growth of algae. This problem may possibly be alleviated by shortening the polishing lagoon detention period. This requires that the first stage treatment efficiency in terms of BOD and SS removal and disinfection be maximized. Specific steps that should be employed to increase first stage treatment efficiency include:

a. Influent lift station pumps should be operated to minimize the large flow rate fluctuations that currently exist. This requires that all three of the influent pumps and their controllers be operational on a continuous basis. To meet this requirement at least one complete pump assembly should be on hand as a standby item, and maintenance procedures should be established to insure that the replaced item is quickly repaired and returned to the shelf as a future standby item.

b. All clarifiers should be drained and inspected annually, and then scheduled for any maintenance required. An inspection should be accomplished as soon as possible to verify the operator's opinion that the sludge scraper arms require maintenance.

c. During a low flow period, the chlorine contact chamber should be by-passed and the large volume of accumulated sludge should be removed.

d. Recirculation through the trickling filters should be maximized, to the extent possible, at all times.

e. The sludge drying bed drainage line should be relocated to the plant influent line.

2. The performance specifications contained in Appendix I should be implemented until they are superseded by the requirements of the NPDES permit currently under preparation by Region IX, EPA.

3. The manning structure of the treatment facility should be reorganized as follows:

a. A civilian certified operator should be placed in complete charge of all aspects of wastewater conveyance and treatment. This individual should be certified by the Division of Water Quality of the California State

Water Resources Control Board, at a Class III level. The certified operator should report directly to the Chief, Civil Engineering Utilities Branch. Existing employees should be given the opportunity to become certified and to compete for the job of treatment facility operator.

4. Once the certified operator is obtained, the total manning allocated to the wastewater treatment facility itself (not including conveyance system lift stations and washrack oil skimmers), should be reduced to approach the level indicated by application of the procedures in Reference 10, which indicates a requirement of three personnel. To meet this level, consideration should be given to eliminating manning on a 24 hour per day basis, or by combining graveyard shift manning with other utilities branch personnel. Due to safety considerations, night shift personnel should however, work in pairs, if the operator is expected to inspect any of the equipment in below grade enclosures.

5. The wastewater treatment facility laboratory should be improved and provided with additional equipment as follows:

a. The laboratory should be rewired to enable all laboratory equipment to function simultaneously without over-loading circuits.

b. An exhaust hood capable of removing the acrid vapors and gases evolved during the analysis of sludge samples, should be installed over the muffle furnace and drying oven.

c. The existing muffle furnace should be replaced with a new unit having an accurate temperature controller.

d. A vacuum pump should be obtained and utilized for the analysis of suspended solids and fecal coliform bacteria.

e. A dissolved oxygen meter with a field probe and a BOD bottle probe should be procured to simplify the measurement of dissolved oxygen and to reduce the manhours expended obtaining dissolved oxygen measurements.

f. A good quality laboratory pH meter should be procured and utilized for all analytical procedures requiring a pH determination.

g. At least two sets of membrane filter kits consisting of a filter flask, filter holder and funnel, should be procured for the determination of suspended solids and fecal coliform organism concentrations.

h. A water bath incubator capable of maintaining  $44.5 \pm 0.2^{\circ}\text{C}$  should be procured for fecal coliform determinations.

i. The new distillation unit currently on hand should be installed. High quality distilled water is a necessity for bioassay procedures, such as BOD, and reagent preparation. After installation, periodic samples

should be collected and analyzed for purity. Analyses can be accomplished by the EHL(M).

j. The laboratory should be provided with a current edition of Standard Methods, which contains the current procedures to be followed for all routine wastewater analyses. In addition, the treatment facility library should, as a minimum, include a copy of references 11, 12, and 13, which provide operational guidance in addition to that available in AFM 85-14, which is outdated and currently under revision.

k. The existing incubator should be replaced with a new unit, having an accurate temperature controller.

l. A heavy duty refrigerator should be procured for sample storage.

m. The Table in Appendix VII, should be used as a realistic guide to the quantity of additional supplies that should be available in the laboratory.

6. With the exception of items related directly to safety conditions, the proposed MCP project to add to, and alter the wastewater treatment facility should be cancelled. The following relatively minor changes should be accomplished however, to maximize first stage treatment efficiency and to permit efficient sample collection for performance monitoring.

a. A pipe should be installed to permit by-passing the chlorine contact chamber to enable accumulated solids to be periodically removed. If possible, a drain line should be installed in the chlorine contact chamber, or a heavy duty portable pump should be made available to drain the chlorine contact chamber for cleaning purposes.

b. The sludge drying bed drainage line should be relocated to discharge at the plant influent line rather than to the chlorine contact chamber.

c. The sludge drying beds should be graded and supplied with additional sand to promote better drainage.

d. The existing variable crest weir at the chlorine contact chamber should be replaced with a weir meeting the requirements of a standard contracted rectangular weir (Ref. 6). The existing flow rate recorder and totalizer should then be calibrated for the standard weir. A permanent staff gage should be installed on the side wall of the chlorine contact chamber such that zero on the staff gage is at the same elevation as the standard weir crest. A calibration curve can then be prepared for the standard weir, and placed in the room housing the installed flow rate recorder. By simply observing the water elevation on the staff gage, and reading the calibration chart, plant operators should at least weekly, verify the accuracy of the installed flow rate meter.

e. The boiler for heating the digester contents should be replaced

with a new unit.

f. The existing waste gas burner should be repaired and kept operational.

g. Automatic proportional, composite wastewater samplers should be installed at the plant influent and polishing lagoon effluent to enable efficient collection of samples for performance testing and documentation. In procuring these units care must be taken to purchase a unit that will collect a representative sample including sewage solids.

7. Operators should be provided with and instructed in the use of the following equipment for entry to confined areas.

a. Combustible gas indicator.

b. Oxygen deficiency meter.

8. The economic and operational feasibility of eliminating Mather's metal plating facility should be investigated. Alternatives include commercial contract services or preferably, contract with the Sacramento Air Logistics Center at McClellan AFB. If it is determined however, to keep the Mather facility operational, the following actions should be taken:

a. Provide for an efficient rinse water conservation program by installation of conductivity controlled rinse water inlet valves.

b. Maintain operational records based on the total area plated or surface treated by each process.

c. Install an effluent monitoring station on the sewer line serving the plating facility. The monitoring station should include the following components:

(1) A critical section such as a Palmer-Bowlus or Parshall flume.

(2) A flow rate recording and totalizing device capable of controlling a flow proportional, composite, effluent sampler.

(3) A flow proportional, composite sampler.

9. Overflow lines from the oil separators serving facilities 3990, 4770, 4250 and 7022, should be plugged to prevent accidental discharges to the storm drainage system.

10. The under flow from gravity oil separators at facilities 2898, 2990, 3320, 7009, and the motor pool vehicle washrack effluent should be discharged to the sanitary sewer.

11. The raw sewage overflow line leading from manhole number 53 to the west drainage ditch should be plugged.

12. Lift station surveillance and maintenance procedures should be improved to insure that the lift station never becomes completely inoperative as it was during the survey period.

13. Plant records of installed equipment and as-built drawings should be updated by a combined effort of plant operators and engineering personnel. Based on this information a formal equipment maintenance program should be developed.

## REFERENCES

1. Mather AFB, Master Plan, Tab A, 1 January 1969, Revised, 1 January 1973.
2. Executive Order 11752, "Prevention, Control, and Abatement of Environmental Pollution at Federal Facilities." 17 December 1973.
3. Air Force Regulation 19-1, "Pollution Abatement and Environmental Quality," 20 February 1974.
4. Methods For Chemical Analysis of Water & Wastes 1971, Environmental Protection Agency, Water Quality Office, Analytical Quality Control Laboratory, Cincinnati, Ohio.
5. Standard Methods for the Examination of Water and Wastewater, 13th Ed., 1971, APHA, AWWA, WPCF.
6. Water Measurement Manual, US Dept. of Interior, Bureau of Reclamation, 2nd Ed., 1967.
7. Process Design Manual For Upgrading Existing Wastewater Treatment Plants, EPA, Roy F. Weston Inc., October 1971.
8. Wastewater Engineering, Collection, Treatment, Disposal, Metcalf & Eddy, Inc., 1972, McGraw-Hill, Inc.
9. Sewage Treatment Plant Design, WPCF, 1967, 3900 Wisconsin Ave, Washington DC, 20016.
10. Estimating Staffing For Municipal Wastewater Treatment Facilities, EPA Contract No. 68-01-0328, March 1973.
11. Operation of Wastewater Treatment Plants, WPCF Manual of Practice No. 11, 1970, Water Pollution Control Federation, 3900 Wisconsin Ave, Washington DC, 20016.
12. Manual Of Instruction For Sewage Treatment Plant Operators, Distributed by Health Education Service, PO Box 7283, Albany, New York 12224.
13. Anaerobic Sludge Digestion, WPCF Manual of Practice No. 16, 1968, Water Pollution Control Federation, 3900 Wisconsin Ave, Washington DC, 20016.



APPENDIX I  
RECOMMENDED PERFORMANCE SPECIFICATIONS

**1. Applicable Orders and Directives:**

Executive Order 11752<sup>(1)</sup>, and current DOD and USAF Directives, require Mather AFB wastewater discharges to comply with the water quality standards adopted by the State of California. Air Force Regulation 19-1<sup>(2)</sup> requires Environmental Health Laboratories, providing a consultative survey to develop performance specifications for the surveyed installation. The performance specifications are defined as permissible limits of emission, discharges, or other values applicable to a particular facility that would as a minimum, provide for conformance with environmental quality standards

**2. Mather AFB Wastewater Treatment Facility Performance Specifications:**

a. Degree of Treatment: As a minimum, Biological treatment, which results in not less than 80% removal of monthly average 5 - day Biochemical Oxygen Demand (BOD<sub>5</sub>), and Suspended Solids (SS), will be provided.

b. Effluent Quality: In addition to the treatment facility performance required above, the effluent quality will meet the standards provided in Table 1.

c. Demonstration of Compliance: The performance specifications necessitate a specific sampling and analysis program to demonstrate compliance. Sampling locations, frequency of analysis and analyses required to demonstrate performance specification compliance are listed in Table 2. This program will provide information for treatment facility control, but it is not intended to preclude or minimize the importance of other operational tests performed by treatment facility operators. Effective demonstration of compliance with the performance specifications requires that the results of the sampling and analysis program be collected, analyzed, interpreted and maintained for future reference. To meet the requirement, results should be recorded on, or attached to, treatment facility operating logs (AF Forms 1462 and 1463).

d. Sample Analysis: All samples will be analyzed according to the procedures specified by the current edition of Standard Methods<sup>3</sup> or Methods For Chemical Analyses<sup>4</sup>.

**e. References:**

(1) Executive Order 11752, "Prevention, Control, and Abatement of Environmental Pollution at Federal Facilities." 17 December 1973.

(2) Air Force Regulation 19-1, "Pollution Abatement and Environmental Quality," 20 February 1974.

(3) Standard Methods for the Examination of Water and Wastewater, 13th Ed., 1971, APHA, AWWA, WPCF.

TABLE 1

EFFLUENT QUALITY REQUIREMENTS (mg/l unless noted)

Item	Maximum Concentration in Any 30-Day Period	Maximum Average Per Consecutive 7 - Day Period	Maximum Average Per Consecutive 30 - Day Period
Fecal Coliform Organisms	N/A	400**	200**
Hydrogen Ion Concentration (pH)***	N/A	6-9	6-9
Total Dissolved Solids	1500	N/A	N/A
Nickel	1.0	N/A	N/A
Cyanide	0.1	N/A	N/A
Copper	0.5	N/A	0.10
Lead	0.1	N/A	N/A
Zinc	0.3	N/A	N/A
Boron	1.5	N/A	1.0
Oil & Grease	20	N/A	N/A
Chromium (Cr+6)	0.05	N/A	N/A
Cadmium	0.05	N/A	N/A
Phenol	0.5	N/A	N/A

\* Colonies / 100 ml sample.

\*\* Geometric mean of one effluent portion collected during a 24 hour period (grab sample).

\*\*\* Units.

TABLE 2

SAMPLING AND ANALYSIS PROCEDURES TO DEMONSTRATE COMPLIANCE  
WITH PERFORMANCE SPECIFICATIONS

Location	Sampling Procedure	Minimum Frequency Required	Analyses Required
Treatment Facility Influent	1 hour intervals, proportional to flow rate, for a 24-hour period	2 times per week	POD, SS
Treatment Facility Effluent*	1 hour intervals, proportional to flow rate, for a 24-hour period	2 times per week	POD, SS
Treatment Facility Effluent*	1 hour intervals, proportional to flow rate, for a 24-hour period	2 times per month	Trace Constituents**
Treatment Facility Effluent*	Grab	2 times per week	Fecal Coliform Organisms
Treatment Facility Effluent**	Grab	Daily	pH

\* Treatment facility discharge to Morrison Creek (normally this will be the polishing lagoon effluent, but if the first stage effluent is discharged directly to Morrison Creek, then it should be sampled and analyzed for Performance Specification Compliance).

\*\* Trace Constituents Include: Total Dissolved Solids, Nickel, Cyanide, Copper, Lead, Zinc, Boron, Oils and Grease, Chromium (Cr + 6) Cadmium and Phenol.

(4) Methods For Chemical Analysis of Water & Wastes 1971,  
Environmental Protection Agency, Water Quality Office, Analytical  
Quality Control Laboratory, Cincinnati, Ohio.

APPENDIX II

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD DISCHARGE  
RESOLUTIONS PERTAINING TO MATHER AFB

SGPAAP

2 JUN 1972

Request for Water Quality Standards

Division of Water Quality  
State Water Resources Control Board  
Room 1140  
1416 Ninth Street  
Sacramento, CA 95814

1. This headquarters is interested in obtaining the prevailing water quality standards required for Mather AFB, located near Sacramento. The specific information required for the area surrounding Mather AFB is as follows:
  - a. State and local effluent standards for industrial and sewage treatment plants;
  - b. State and local stream standards;
  - c. Any other pertinent water quality standards.
2. This information is required to monitor our bases in Air Training Command in relation to environmental protection efforts.
3. Please forward the above information to this office and, if possible, place us on your mailing list for future changes in standards.
4. Your assistance in this matter will be appreciated.

JOHN K. GIBEAU, Captain, USAF, BSC  
Command Bioenvironmental Engineer

Return address

California Regional Water Quality Control Board  
Central Valley Region  
325 S Street  
Sacramento, California 95816



## BASIS FOR REQUIREMENTS

MATHER FIELD, U.S.A.F., SACRAMENTO COUNTY

RESOLUTION No. 117

Johnson and Associates, Consulting Engineers for Mather Field requested requirements for the effluent from the sewage disposal facilities serving Mather Field discharged to Morrison Creek.

Morrison Creek is a sluggish, weed choked drainage channel which meanders through the County eventually draining to a series of lakes and into Snodgrass Slough emptying into the Sacramento River below Sacramento. The Creek flows through a highly populated suburban region. There are no known uses of the waters entering the Creek and the main use of the drain is for disposal surface drainage and wastes. Wastes from the Sacramento Signal Depot are discharged to the Creek and about 4000 g.p.m. of cooling water will be discharged into the drain below the Signal Depot by the new Proctor and Gamble plant.

The Regional Board contacted other State agencies interested in this discharge. The State Department of Public Health emphasized the importance of mosquito control operations in Morrison Creek. Sewage effluents provide excellent mediums for mosquito breeding unless adequate drainage facilities permit rapid runoff. The Health Department also pointed out the possibilities of cross-connection hazards if the sewage plant water supply is directly connected to a public water supply.

The Requirements are based upon prevention of nuisance and pollution in Morrison Creek.

The State agencies contacted all concurred with the requirements. No protest has been received from Mather Field authorities.



RESOLVED, that the following requirements shall govern the nature of the discharge from the sewage treatment facilities serving Mather Field to Morrison Creek:

1. The discharge shall have received adequate disinfection or its equivalent effect prior to discharge to Morrison Creek;
2. The discharge shall not have a 5 day biochemical oxygen demand in excess of 20% of that of the untreated sewage;
3. The discharge shall not contain settleable solids in excess of 0.5 ml/liter;
4. Neither the plant nor the disposal shall cause a nuisance or a pollution in Morrison Creek.

If, in the future, there is a change in the conditions or use of the disposal area or of Morrison Creek, it may be necessary for the Central Valley Regional Water Pollution Control Board to revise the requirements to conform to the new conditions or use.

*Passed February 20, 1952*

\_\_\_\_\_  
Chairman

ATTEST:

\_\_\_\_\_  
Executive Officer

## BASIS FOR REQUIREMENTS

### MATHER AIR FORCE BASE - INDUSTRIAL WASTE SACRAMENTO COUNTY

MATHER AIR FORCE BASE IS LOCATED IN SACRAMENTO COUNTY ABOUT 10 MILES SOUTH EAST OF SACRAMENTO. INDUSTRIAL WASTES ORIGINATE FROM ENGINE OVERHAUL AND REPAIRS, STRIPPING, WASHING, DEPAINTING OF AIRCRAFT AND THE GENERAL SERVICING OF OTHER MISCELLANEOUS VEHICLES AND EQUIPMENT. THE MAJOR CONSTITUENTS OF THE WASTE WILL BE FREE AND EMULSIFIED OILS, GREASES, LIGHT HYDROCARBONS, PHENOLS, CHROMATES, CYANIDES, NICKEL, DETERGENTS ACIDS AND ALKALIS.

MORRISON CREEK WHICH TRAVERSES A PORTION OF THE BASE, IS A SLUGGISH INTERMITTENT NATURAL CREEK WITH YEAR ROUND FLOW DUE TO THE DISCHARGES CONTRIBUTED BY THE BASE DOMESTIC SEWAGE TREATMENT PLANT, SACRAMENTO SIGNAL DEPOT, PROCTER AND GAMBLE COMPANY COOLING WATER AND DRAINAGE FROM ADJACENT LANDS.

AT PRESENT THE INDUSTRIAL WASTE IS COLLECTED FROM VARIOUS POINTS AND DISCHARGED TO THE STORM DRAINAGE SYSTEM WHICH EVENTUALLY GOES INTO MORRISON CREEK. NO ESTIMATE HAS BEEN MADE ON THE VOLUME OF THE WASTE NOR HAS THERE BEEN ANY DETAILED LABORATORY ANALYSIS OF THE WASTE, BUT AN IMMEDIATE SAMPLING PROGRAM IS TO BE STARTED WHICH WILL YIELD RESULTS BOTH AS TO THE CHEMICAL AND BIOLOGICAL VALUES AS WELL AS THE VOLUME TO BE HANDLED. THE WASTE DISCHARGE WILL BE THAT DISCHARGE OCCURRING DOWNSTREAM OF THE CONFLUENCE OF THE 1.0 MGD DOMESTIC PLANT EFFLUENT AND THE TREATED INDUSTRIAL EFFLUENT. THE COMBINED EFFLUENTS WILL THEN DISCHARGE TO MORRISON CREEK. AFTER THE REQUIREMENTS HAVE BEEN ESTABLISHED AND THE INDUSTRIAL PLANT IS OPERATIONAL, A MONITORING PROGRAM WILL BE ESTABLISHED AND CONTINUED IN USE TO ASSESS AND EVALUATE THE DISCHARGE.

#### REQUIREMENT No. 1

THIS PROTECTS THE DISSOLVED OXYGEN BALANCE IN MORRISON CREEK IN ACCORD WITH RESOLUTION No. 53-45, WHICH RESOLUTION CALLS FOR A MINIMUM D.O. OF 2.0 PPM.

#### REQUIREMENT No. 2 AND 3

THESE REQUIREMENTS ARE SELF-EXPLANATORY.

#### REQUIREMENT No. 4 AND 5

THE LIMITS ON THE SPECIFIC ITEMS ESTABLISHED HERE ARE THOSE NEEDED TO PROTECT DOWNSTREAM WATERS FOR IRRIGATION AND WASTE DISPOSAL PURPOSES.

#### REQUIREMENT No. 6

THIS REQUIREMENT IS SELF-EXPLANATORY.

#### REQUIREMENT No. 7

THIS REQUIREMENT PROTECTS THE DOWNSTREAM WATERS FOR THEIR ESTABLISHED BENEFICIAL USES AGAINST ANY UNDEFINED MATERIALS OR EFFECTS OF THE DISCHARGE.

#### REQUIREMENT No. 8 AND 9

THESE REQUIREMENTS PROHIBIT SLUDGE DEPOSITS OR VISIBLE OILS WHICH MIGHT LEAD TO NUISANCE CONDITIONS.

RESOLUTION  
INDUSTRIAL WASTE DISCHARGE REQUIREMENTS  
MATHER AIR FORCE BASE  
SACRAMENTO COUNTY

OLUTION No: 61-150

ADOPTED: 12/14/61

WHEREAS, MATHER AIR FORCE BASE DISCHARGES WASTES FROM AIRCRAFT STRIPPING AND MAINTENANCE OPERATIONS TO MORRISON CREEK; AND,

WHEREAS, MATHER AIR FORCE BASE HAS REQUESTED THAT REQUIREMENTS BE ESTABLISHED REGARDING ITS INDUSTRIAL WASTE DISCHARGE TO MORRISON CREEK; AND,

WHEREAS, MORRISON CREEK IS AN INTERMITTENT NATURAL STREAM BUT HAS A YEAR ROUND FLOW DUE TO THE DISCHARGE OF TREATED SEWAGE FROM THE MATHER AIR FORCE BASE DOMESTIC WASTEWATER TREATMENT PLANT, COOLING WATER FROM THE PROCTER AND GAMBLE COMPANY, PERIODIC TREATED INDUSTRIAL AND DOMESTIC WASTE DISCHARGES FROM THE SACRAMENTO SIGNAL DEPOT AND DRAINAGE FROM ADJACENT LANDS; AND,

WHEREAS, THE CENTRAL VALLEY REGIONAL WATER POLLUTION CONTROL BOARD, IN RESOLUTION No. 53-45 ADOPTED AUGUST 29, 1953, ESTABLISHED CONDITIONS TO BE MAINTAINED IN MORRISON CREEK; AND,

WHEREAS, IT IS THE INTENT OF THE CENTRAL VALLEY REGIONAL WATER POLLUTION CONTROL BOARD TO MAINTAIN THE QUALITY OF THE RECEIVING WATERS AT THEIR PRESENT LEVELS IN ACCORD WITH RESOLUTION No. 53-45 AND TO PREVENT THE DISCHARGE FROM BECOMING A NUISANCE OR A POLLUTION; THEREFORE BE IT

RESOLVED, THAT THE FOLLOWING REQUIREMENTS SHALL GOVERN THE NATURE OF THE INDUSTRIAL WASTE DISCHARGE FROM MATHER AIR FORCE BASE TO MORRISON CREEK:

1. WASTE DISCHARGE SHALL NOT CAUSE THE DISSOLVED OXYGEN IN MORRISON CREEK TO FALL BELOW 2.0 PPM.
2. THE WASTE DISCHARGE SHALL NOT CAUSE A POLLUTION OF USEABLE GROUND OR SURFACE WATERS.
3. NEITHER THE DISPOSAL SYSTEM NOR THE DISCHARGE SHALL CAUSE A NUISANCE BY REASON OF ODORS OR UNSIGHTLINESS.
4. THE WASTE DISCHARGE SHALL NOT CONTAIN CONCENTRATIONS OF MATERIALS IN EXCESS OF THE FOLLOWING:

TOTAL DISSOLVED SOLIDS	1500	PPM
NICKEL	1.0	PPM
CYANIDE	0.1	PPM
COPPER 0.5 PPM MAXIMUM IN ANY 30 DAY PERIOD	0.1	PPM MONTHLY AVERAGE
LEAD	0.1	PPM
ZINC	0.3	PPM
BORON 1.5 PPM MAXIMUM IN ANY 30 DAY PERIOD	1.0	PPM MONTHLY AVERAGE
OILS	20	
CHROMIUM, Cr+6	0.05	PPM
CADMIUM	0.05	PPM
PHENOL	0.5	PPM

MATHER AIR FORCE BASE - INDUSTRIAL WASTE  
SACRAMENTO COUNTY

5. THE PH OF THE WASTE DISCHARGE SHALL NOT FALL BELOW 6.5 NOR EXCEED 8.5.
6. WASTE DISCHARGE SHALL NOT CAUSE UNSIGHTLY BIOLOGICAL GROWTHS IN THE RECEIVING WATERS.
7. THE WASTE DISCHARGE SHALL NOT CAUSE CONCENTRATIONS OF MATERIALS IN THE RECEIVING WATERS WHICH ARE DELETERIOUS TO HUMAN, PLANT, ANIMAL, OR AQUATIC LIFE.
8. THE WASTE DISCHARGE SHALL NOT CAUSE SLUDGE DEPOSITS IN THE RECEIVING WATERS.
9. THE WASTE DISCHARGE SHALL NOT CAUSE VISIBLE OIL OR GREASE SLICKS ON THE RECEIVING WATERS, OR CAUSE SUCH DEPOSITS ON THE BANKS OF DOWNSTREAM WATER COURSES.

RESOLVED, FURTHER, THAT THE DISCHARGER WILL BE REQUIRED TO SUBMIT TECHNICAL REPORTS RELATIVE TO THE WASTE DISCHARGE AS PROVIDED FOR UNDER SECTION 13055 OF DIVISION 7, CALIFORNIA WATER CODE.

IF, IN THE FUTURE, THERE IS A CHANGE IN THE CONDITIONS OF THE DISCHARGE, OR USE OF THE DISPOSAL AREA, IT MAY BE NECESSARY FOR THE REGIONAL BOARD TO REVISE THESE REQUIREMENTS TO CONFORM TO THE NEW CONDITIONS OR USE.

THESE REQUIREMENTS DO NOT AUTHORIZE THE COMMISSION OF ANY ACT RESULTING IN INJURY TO THE PROPERTY OF ANOTHER OR PROTECT THE DISCHARGER FROM HIS LIABILITIES UNDER FEDERAL, STATE AND LOCAL LAWS.

/s/ CLIFFORD E. PLUMMER



ATTEST:

/s/ JOSEPH S. BORLINSKI

EXECUTIVE OFFICER

APPENDIX III

ENVIRONMENTAL PROTECTION AGENCY EFFLUENT GUIDELINES AND  
STANDARDS FOR ELECTROPLATING (40 CFR 413) AND PLATING  
FACILITY PRODUCTION 28 - 30 JANUARY 1974

# ENVIRONMENTAL PROTECTION AGENCY EFFLUENT GUIDELINES AND STANDARDS FOR ELECTROPLATING

(40 CFR 413; 39 FR 11510, March 28, 1974)

## Title 40—Protection of the Environment CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

### SUBCHAPTER N—EFFLUENT GUIDELINES AND STANDARDS

#### PART 413—ELECTROPLATING POINT SOURCE CATEGORY

##### Subpart A—Electroplating of Copper, Nickel, Chromium, and Zinc on Ferrous and Nonferrous Materials Subcategory

##### 413.10 Applicability; description of the electroplating of copper, nickel, chromium, and zinc on ferrous and nonferrous materials subcategory.

The provisions of this subpart are applicable to discharges of pollutants resulting from the process in which a ferrous or nonferrous base material is rack or barrel electroplated with copper, nickel, chromium, zinc, or any combination thereof.

##### 413.11 Specialized definitions.

For the purpose of this subpart:

(a) Except as provided below, the general definitions, abbreviations and methods of analysis set forth in 40 CFR Part 16 shall apply to this subpart.

(b) The term "sq in" shall mean the area plated with copper, nickel, chromium, zinc, or treated by chromating expressed in square inches.

(c) The term "sq ft" shall mean the area plated with copper, nickel, chromium, zinc, or treated by chromating expressed in square feet.

(d) The term "operation" shall mean any step in the plating process in which copper, nickel, chromium, or zinc metal chromate is deposited on a base material following by a rinse.

(e) The term "CN,A" shall mean those anodes amenable to chlorination as described in 1972 Annual Book of ASTM Standards, 1972, Standard D 2036-72, Method B, page 553.

##### 413.12 Effluent limitations guidelines representing the degree of effluent reduction attainable by the applica- tion of the best practicable control technology currently available.

In establishing the limitations set forth in this section, EPA took into account all information it was able to collect, develop and solicit with respect to factors (such as age and size of plant, raw materials, manufacturing processes, products produced, treatment technology available, energy requirements and costs) which can affect the industry subcategory and effluent levels established. It is, however, possible that data which would affect these limitations have been available and, as a result, these limitations should be adjusted for cer-

tain plants in this industry. An individual discharger or other interested person may submit evidence to the Regional Administrator (or to the State, if the State has the authority to issue NPDES permits) that factors relating to the equipment or facilities involved, the process applied, or other such factors related to such discharger are fundamentally different from the factors considered in the establishment of the guidelines. On the basis of such evidence or other available information, the Regional Administrator (or the State) will make a written finding that such factors are or are not fundamentally different for that facility compared to those specified in the Development Document. If such fundamentally different factors are found to exist, the Regional Administrator or the State shall establish for the discharger effluent limitations in the NPDES permit either more or less stringent than the limitations established herein, to the extent dictated by such fundamentally different factors. Such limitations must be approved by the Administrator of the Environmental Protection Agency. The Administrator may approve or disapprove such limitations, specify other limitations, or initiate proceedings to revise these regulations.

(a) The following limitations establish the quantity or quality of pollutants or pollutant properties, controlled by this section, which may be discharged by a point source subject to the provisions of this subpart after application of the best practicable control technology currently available:

Effluent characteristic	Effluent limitations	
	Maximum for any 1 day	Average of daily values for 30 consecutive days shall not exceed—
Metric units (milligrams per square meters per operation)		
Cu.....	160	80
Ni.....	160	80
CrVI.....	16	8
Cr, total.....	160	80
Zn.....	160	80
CN,A.....	16	8
CN, total.....	160	80
TSS.....	4,800	3,200
pH.....	Within the range 6.0 to 9.5.	
English units (pounds per million square feet per operation)		
Cu.....	32.7	16.4
Ni.....	32.7	16.4
CrVI.....	3.3	1.6
Cr, total.....	32.7	16.4
Zn.....	32.7	16.4
CN,A.....	3.3	1.6
CN, total.....	32.7	16.4
TSS.....	982.0	640.0
pH.....	Within the range 6.0 to 9.5.	

(b) Pursuant to section 308 of the Act, point sources subject to the provisions of this subpart shall maintain records of production expressed in sq m or sq ft as defined in § 413.11 for the purpose of determining compliance with the effluent limitations in § 413.12(a) of this subpart. For the purpose of complying with the requirements of this paragraph, a discharger may establish a correlation between area plated and another parameter, such as ampere-hours used in plating.

(c) Application of the factors listed in section 304(b) requires variation from the effluent limitations set forth in § 413.12(a) for any point source subject to such effluent limitations with a production less than 33 square meters per hour or an installed direct current capacity less than 2000 amperes. For such sources, the best practicable control technology currently available consists of cyanide destruction, if any, equalization and pH adjustment to a range of 6.0 to 9.0 prior to discharge.

##### § 413.13 Effluent limitations guidelines representing the degree of effluent reduction attainable by the applica- tion of the best available technology economically achievable.

(a) The following limitations establish the quantity or quality of pollutants or pollutant properties, which may be discharged by a point source subject to the provisions of this subpart after application of the best available technology economically achievable: there shall be no discharge of process waste water pollutants to navigable waters.

(b) Application of the factors listed in section 304(b) of the Act may require variation from the effluent limitation set forth in this section for any point source subject to such effluent limitation with a production less than 120 sq m per hour. If variation is determined to be necessary for any such source, such source shall be subject to effluent limitations no less stringent than those required by the standards of performance for new sources set forth in § 413.15.

##### § 413.14 [Reserved]

##### § 413.15 Standards of performance for new sources.

(a) The following standards of performance establish the quantity or quality of pollutants or pollutant properties, controlled by this section, which may be discharged by a new source subject to the provisions of this subpart:

Effluent characteristic	Effluent limitations	
	Maximum for any 1 day	Average of daily values for 30 consecutive days shall not exceed
Metric units (milligrams per square meters per operation)		
Cu.....	80	40
Ni.....	80	40
CrVI.....	8	4
Cr, total.....	80	40
Zn.....	80	40
CN <sub>A</sub> .....	8	4
CN, total.....	80	40
TSS.....	2,400	1,600
pH.....	Within the range 6.0 to 9.5.	
English units (pounds per million square feet per operation)		
Cu.....	18.4	8.2
Ni.....	18.4	8.2
CrVI.....	1.6	.8
Cr, total.....	18.4	4.2
Zn.....	18.4	4.2
CN <sub>A</sub> .....	1.6	.8
CN, total.....	18.2	4.7
TSS.....	491.0	327.0
pH.....	Within the range 6.0 to 9.5.	

(b) Pursuant to section 308 of the Act, point sources subject to the provisions of this subpart shall maintain records of production expressed in sq m or sq ft as defined in § 413.11 for the purpose of determining compliance with the effluent limitations in § 413.15(a) of this subpart. For the purpose of complying with the requirements of this paragraph, a discharger may establish a correlation between area plated and another parameter, such as ampere-hours used in plating.

#### § 413.16 Pretreatment standards for new sources.

The pretreatment standards under section 307(c) of the Act for a source within the electroplating of copper, nickel, chromium and zinc on ferrous and nonferrous materials subcategory, which is a user of a publicly owned treat-

ment works (and which would be a new source subject to section 306 of the Act, if it were to discharge pollutants to the navigable waters), shall be the standard set forth in 40 CFR Part 128, except that, for the purpose of this section, 40 CFR 128.133 shall be amended to read as follows:

In addition to the prohibitions set forth in 40 CFR 128.131, the pretreatment standard for incompatible pollutants introduced into a publicly owned treatment works shall be the standard of performance for new sources specified in 40 CFR 413.16; provided that, if the publicly owned treatment works which receives the pollutants is committed, in its NPDES permit, to remove a specified percentage of any incompatible pollutant, the pretreatment standard applicable to users of such treatment works shall, except in the case of standards providing for no discharge of pollutants, be correspondingly reduced in stringency for that pollutant.

SGPM/Capt Hollett/2284/cs/29 Mar 74

SGPM (Capt Hollett, 2284)

29 MAR 1974

Plating Shop Bldg 4150 - Waste Water Survey  
28 January Through 30 January 1974

#### Memo of Record

The Brailford DU-2 Sampler (SN 73828) was placed in the combined plating and cleaning shop drainline at the junction with the battery shop floor drain. The sampling line was implaced through a 3 ft. long 3" diameter pipe on 26 January with a great assist from Mr. Laughlin of the battery shop who suggested the use of a foam rubber ball as a carrier to drag the sampling hose through the trap and into the mainline. It worked very well. The sampling began at 0800 on 28 January. No plating had been accomplished that morning prior to sampling start up. Mr. Lish, plating shop foreman, will establish a log of all work by part and square footage for this week. He suggested a 16 hour sampling period since they are presently working two men on two shifts per day. It was agreed to run two consecutive eight hour shifts. The two gallon sample container will be treated with four ml/l of concentrated nitric acid. In eight hours  $5\frac{1}{2}$  (1) will be accumulated at the maximum sampling rate, therefore 22ml of acid were used. The samples will be serviced at 0700 and 1130 hours for several days to insure a representative operational period has been monitored.

*Bruce A. Hollett*  
BRUCE A. HOLLETT, CAPT., USAF, ESC  
Bio-Environmental Engineer

- 2 Atch  
1. Process Record  
2. Laboratory Analysis Results



# CLEANING AND PLATING SHOP

323rd FMS, BLDG 4150

28 Jan 74, Day Shift 0700-1545

<u>Tank</u>	<u>Amount</u>	<u>Size</u>	<u>Name</u>
Chromcoat	1	5" x 23'8"	Duct -
"	1	6" x 13'1"	Duct
"	1	5 1/2" x 12'	Duct
"	3	12" x 14"	Fire Door
"	2	2" x 4" x 6"	Adapter
Cadmium	15	1" x 1"	Screw Jack
Cadmium	3	1" x 2"	Fire Door
<u>Swing Shift - 1530-2400</u>			
Cadmium	14	14" x 3/4"	Sus. Rings
Cadmium	12	14" x 3/16"	Tube Rings
Cadmium	12	14" x 1/4"	Flat Rings
Cadmium	6	7/8" x 1/2"	Nuts
Cadmium	12	1" x 3/4"	Nuts
Cadmium	12	1" x 1/4"	Bolts
Anodize	3	75 1/2" x 14 3/8"	Prop Blades
Cadmium	1	1" x 4 1/2"	"V" Intake
Cadmium	8	31 1/2" x 1 1/2"	Cooler Supports
Chromcoat	1	52 1/4" x 4 1/2"	Sheet 697 Shroud
Chromcoat	2	5 1/2" x 4"	Sheet 697 Shroud

AS Jan 74 - Swing Shift cont'd.

<u>Unit</u>	<u>Amount</u>	<u>Size</u>	<u>Name</u>
Cadmium	17	$\frac{1}{4}" \times 3\frac{1}{2}" \times 3"$	Seat Buckles
Cadmium	32	$1\frac{1}{8}" \times 5 \times 2$	Seat Buckles
Cadmium	34	23"	Round Stock Seat Buckles
Cadmium	17	$\frac{1}{4}" \times 3\frac{1}{2}" \times 4"$	Seat Buckles
Cadmium	9	$7" \times 1" \times 3/4"$	Bar (SAC) Brake Parts
Cadmium	9	$7\frac{1}{2}" \times 1 \times \frac{1}{2}$	Bar (SAC)
Cadmium	36	$7\frac{1}{2}" \times 3/4" \times 1"$	Bar (SAC)

29 Jan 74 Day Shift - 0700-1545

<u>Rank</u>	<u>Amount</u>	<u>Size</u>	<u>Name</u>
Chromacote	11	$\frac{1}{2}$ " x 11'	Duct
Chromacote	1	6" x 5'2"	Duct
Chromacote	1	$4\frac{1}{2}$ " x 2'5"	Duct
Chromacote	1	5" x 1'3"	Duct
Cadmium	1	14" x 36"	Pail
Chromacote	3	12" x 5"	Fire Door
Chromacote	1	5" x 12'5"	Duct
Chromacote	1	6" x 7'5"	Duct
Cadmium	2	12" x 4"	Brk SAC
Cadmium	15	1" x 1"	Fire Door Assy
Cadmium	20	1" x 2"	Screw Jack Assy

Swing Shift - 1530-2400

Cadmium	1	20" x $13\frac{1}{4}$ " $\frac{1}{2}$ "	Bar (SAC)
Anodize	3	$75\frac{1}{2}$ " x $14\frac{3}{8}$ "	Frop Blades
Cadmium	2	$2\frac{1}{4}$ " x $13\frac{1}{4}$ " x $5\frac{1}{8}$ "	Bars (SAC)
Cadmium	43	8" each	Rods (SAC)
Cadmium	1	9" x 1" x $1\frac{1}{4}$ "	Nut



30 Jan 74 Day Shift - 0700-1545

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<u>Task</u>	<u>Amount</u>	<u>Size</u>	<u>Name</u>
1 CAD	12	10" x 3"	Prop cart
2 CAD	12	1" x 2"	Prop cart
3 CAD	24	1" x 1"	Nut and Bolt
Copper	4	8" x 9"	Pan
1 Chromacoat	1	5/8" x 53"	Clamps
2 Chromacoat	1	6" x 1'9"	Aug Tube Mounts
3 Chromacoat	1	4 1/2" x 1'6"	Aug Tube Mounts
4 Chromacoat	1	6 1/2" x 5 1/2"	Valve
Chromacoat	1	6" x 9"	Duct
6 Chromacoat	1	5" x 7' 11 1/2"	Duct
CAD	66	1" x 2"	Cowl Parts
CAD	2	1" x 10"	Cowl Parts
2 Chromacoat	2	10" x 14"	Cowl Parts
Chromacoat	1	12" x 30"	Cowl Parts
7 Chromacoat	1	12" x 12" x 6"	Cowl Parts
Chromacoat	12	5" x 7"	Cowl Parts

Swing Shift - 1530-2400:

Cadmium	2	8 1/4" x 13/4 x 5/8	Bars (SAC)
2 Cadmium	3	16 1/4" x 1 1/4" x 5/8"	Bars (SAC)
Chromacoat	1	4" x 4"	...
Cadmium	6	14 1/2" x 1" x 1/8"	...

30 Jan '74 - 7 wire unit cont'd.

<u>Part</u>	<u>Amount</u>	<u>Size</u>	<u>Part</u>
✓ Cadmium	6	$14\frac{1}{2} \times 2 \times 3/16"$	Suspensions
✓ Cadmium	4	$12" \times 1\frac{1}{3}"$	Washers
✓ Cadmium	6	$5" \times \frac{1}{4}"$	Washers
Cadmium	6	$7/8" \times \frac{1}{2}"$	Nuts
Cadmium	6	$1" \times 3/4"$	Nuts

APPENDIX IV

EHL-(M) METHOD FOR DETERMINATION OF  
PESTICIDES CONCENTRATION

## ABSTRACT

The purpose of this method is to determine the extent and magnitude of pesticide or herbicide contamination in various environmental samples. The primary list of pesticide compounds was established in March 1964 by the Subcommittee on Monitoring, Federal Committee on Pest Control. The pesticides selected were the ones most commonly and widely used, including nine chlorinated insecticides and three herbicides.

The method used is very similar to that used by the U.S. Geological Survey.

The principle of the method is separating chlorinated pesticides by gas chromatography on two differently packed glass columns. Standard known chlorinated pesticides are gas chromatographed and retention time noted on both columns. Each column has a different retention time for a given material so that an unknown detected compound can be determined and compared to the standard pesticide retention times and identified. The concentric tube type of electron capture detector is used because there is a tenfold increase of sensitivity of detection compared to the Lovelock parallel plate type detector. Because of the high sensitivity of the electron capture detector, a one-liter water sample can be extracted with hexane, concentrated to 5 ml, and 5 microliters injected into the gas chromatograph to determine chlorinated pesticides in the range of 5-20 nanogram pesticide per liter of water sample.

Herbicides are first extracted with diethyl ether and methylated with 14 percent boron trifluoride-methanol solution, then gas-chromatographed similarly to the chlorinated pesticide method.

All glassware used for the analysis must be free from organic contamination.

#### A. REAGENTS

1. Hexane distilled in glass
2. Benzene distilled in glass
3. Ether distilled in glass
4. Acetonitrile distilled in glass
5. Concentrated  $\text{H}_2\text{SO}_4$
6. Concentrated  $\text{H}_3\text{PO}_4$
7. Acid washed anhydrous  $\text{Na}_2\text{SO}_4$
8. Anhydrous  $\text{Na}_2\text{SO}_4$
9. Florisil activated at  $650^\circ\text{C}$
10. Woelm alumina<sup>1</sup>

#### B. MATERIALS

1. Pyrex glass tubing, 1/8 inch O.D.
2. Glass wool
3. Gas-chrom<sup>2</sup> Q 60/80 mesh

#### C. EQUIPMENT AND GLASSWARE

1. Varian Aerograph HY-FI III Model 1200 with a proportional temperature programmer, or similar instrument with electron capture detector.
2. Varian Aerograph Model 30 Recorder, 0-1 MV, half inch per minute or equivalent.

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<sup>1</sup>Alupharm Chemicals, New Orleans, La.

<sup>2</sup>Applied Science Laboratories, Inc., State College, Pa.



3. Prepurified nitrogen with pressure regulator
4. Fluidized sand bath
5. Kuderna-Danish evaporator, 125 ml with various size concentrator tubes
6. One-liter separatory flask
7. Two-liter separatory flask
8. 125 ml Erlenmeyer flask
9. Various size volumetric flasks
10. Quart mason jars with teflon lined covers

#### D. COLUMN PREPARATION

1. DC-200 silicone grease is coated 5 percent by weight on 60/80 mesh Gas-chrom Q. The material is also coated with 0.5 percent carbowax 20M, and packed into 1.5 mm - ID, 3 mm - OD heat resistant glass column, 5 feet long.

2. SE-30 2 percent by weight, QF1 - fluorinated silicone 2.4 percent by weight, carbowax 20M 0.5 percent by weight are coated on 60/80 mesh Gas-chrom Q and packed into 1.5 mm - ID, 3 mm - OD heat-resistant glass column, 5 feet long.

#### E. PREPARATION OF STANDARDS

1. Pesticide standards purchased commercially are prepared to contain from  $2 \times 10^{-9}$  g to  $5 \times 10^{-12}$  g per  $\mu$ l (microliter) in hexane in a volumetric flask.

2. Herbicide standards are prepared from their methyl esters to contain from  $2 \times 10^{-9}$  g to  $5 \times 10^{-12}$  g per  $\mu$ l (microliter) in hexane or benzene in a volumetric flask.

## **F. PROCEDURE**

### **1. Sample Collection of Chlorinated Pesticide**

a. The water sample is collected, using a precleaned quart mason jar with a Teflon lined cover. The jar is submerged directly into water source to collect sample. One-half inch air space is left on top in the container.

b. The soil sample is collected in a precleaned quart mason jar. The soil surface layer is shoveled away, and the core is taken with coring tool. Coring equipment must be cleaned with acetone before use to prevent contamination of sample.

c. Vegetation Samples: The top portion and root section should be separated and packaged in individual paper sacks, not plastic bags.

d. Fish samples will be shipped frozen in individual paper sacks.

2. Sample Collection for Herbicides: Identical to that for chlorinated pesticides.

### **3. Cleaning of Glassware**

a. All glassware, except volumetric glassware, is heated to 300°C for eight hours to eliminate organic contamination.

b. Volumetric glassware is cleaned with sodium dichromate in concentrated sulfuric acid cleaning solution.

### **4. Operating Parameters of the Gas Chromatograph:**

a. Oven temperature: 175°C.

b. Electron-capture detector, concentric tube design, D.C. mode, 90 volts: 210°C.

c. Injection port temperature: 210°C.

d. Nitrogen (prepurified) carrier gas: 40 ml per minute.

e. Injection volume: 5  $\mu$ l (microliter).

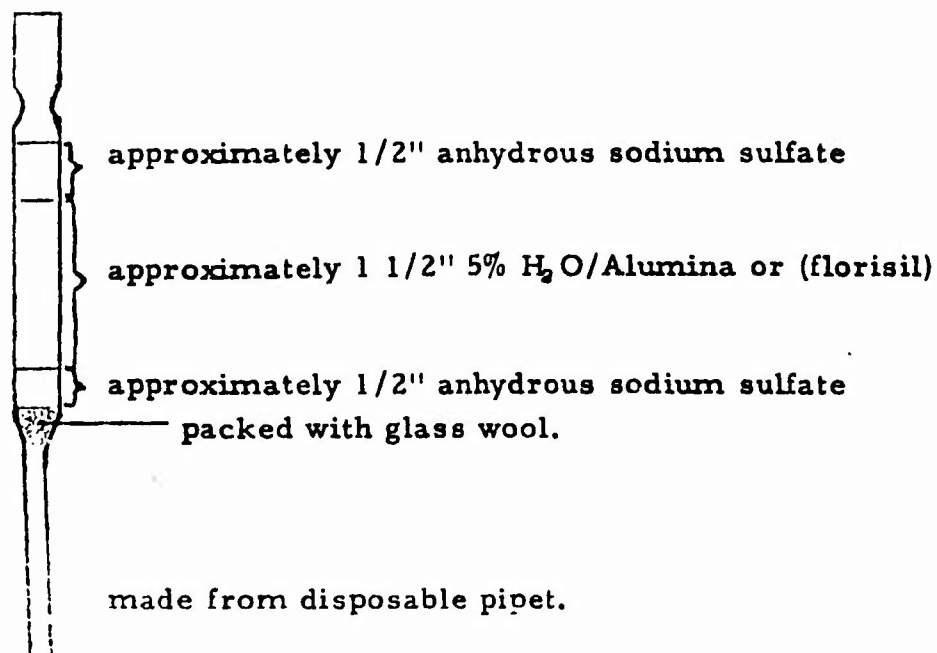
5. Sample Preparation and Gas Chromatographic Analysis:  
Chlorinated Pesticides in Water.

a. Extract the pesticides with 25 ml hexane in the sampling jar using a magnetic stirring bar to agitate the sediment and water in the container so it is exposed to the solvent. Pour the sample into a one-liter separatory funnel and separate the hexane layer and water. Collect the aqueous layer in the original one-quart bottle. Pour the hexane layer into a 125 ml Erlenmeyer flask.

b. Repeat the above procedure three times so that the total volume of hexane is 75 ml. Add anhydrous  $\text{Na}_2\text{SO}_4$  to remove any water.

c. Decant the combined extracts from the sodium sulfate into a Kuderna-Danish concentrating apparatus. Concentrate to 5 ml at  $100^\circ\text{C}$  on a fluidized sand bath. If the solution is colored, concentrate to 0.50 ml and proceed with next step.

d. If the solution is highly colored, use a micro alumina cleanup column or a Florisil<sup>R</sup> cleanup column. Alumina column is prepared by adding 5 percent  $\text{H}_2\text{O}$  to alumina. Then elute the 0.5 ml concentrate through the cleanup column with hexane into a 5 ml volumetric flask.



e. Take 5  $\mu$ l (microliter) aliquot of the sample with a 10 microliter syringe and inject into the gas chromatograph. The injections are made on both 5 percent DC 200 and 2 percent SE 30 plus 2.4 percent QF-2 columns to facilitate identification of the pesticides. The operating conditions for both columns are the same. The glass-lined injection ports are held at 210° and the columns are heated at 175°. The prepurified nitrogen carrier gas dried by molecular sieve (Linde Type 13X) is regulated at 40 ml per minute.

f. The electron-affinity potential of each pesticide may be different so that standardization curves must be determined and retained for quantitative analysis. Quantitative pesticide standards are injected on the same day to aid in identification to provide correction factor for day-to-day changes in the gas-chromatographic response.

## 6. Herbicide in Water

a. Acidify (pH 2.0) the one-liter water sample with concentrated sulfuric acid.

b. Pour the sample into a two-liter separatory funnel. Add 150 ml diethyl ether to the sample bottle, rinsing the sides, and pour the solvent into the separatory funnel. Shake the mixture vigorously for one minute. Repeat three times. Since ether is highly soluble in water, the sample must be saturated with ether before extraction.

c. Pour the ether extract into a T joint 250 ml Erlenmeyer flask containing 2 ml of 37 percent aqueous potassium hydroxide. Add 15 ml H<sub>2</sub>O and insert a one-ball Snyder column. Evaporate the ether on a steam bath; reflux for approximately 90 minutes.

d. Transfer the concentrate to a 60 ml separatory funnel. Extract the basic solution three times with 20 ml ether and discard the ether layer. Acidify the aqueous layer with 2 ml of cold 4:1 aqueous sulfuric acid to pH 2 and extract the herbicides with 20 ml ether three times. Transfer the ether layer to a 125 ml Erlenmeyer flask containing about 0.5 gram acid washed anhydrous Na<sub>2</sub>SO<sub>4</sub>. Allow the extract to remain in contact with the Na<sub>2</sub>SO<sub>4</sub> in an explosion proof refrigerator for two hours.

e. Transfer the ether solution into a Kuderna-Danish evaporator-concentrator apparatus and add 0.5 ml benzene. Concentrate the extract to about 0.5 ml, using a fluidized sand bath at 70°C.

f. When the concentrated extract is cool, add 0.5 ml of 14 percent  $\text{BF}_3$ -methanol reagent. Heat the contents at  $50^\circ\text{C}$  for 30 minutes in a sand bath.

g. Cool and add 4.5 ml of 5 percent aqueous  $\text{Na}_2\text{SO}_4$  solution to the reaction mixture, shake for one minute, allow to stand for approximately three minutes for phase separation.

h. The benzene layer is pipetted from the receiver and passed through a micro cleanup column of florisil with more benzene to a volume of 5 ml.

i. Gas chromatograph the methyl ester of chlorinated phenoxyacid through the same gas chromatographic columns as chlorinated pesticides.

j. Compare with known quantities of prepared herbicide standards.

7. Pesticides in Soil: Composites of soil samples (100 grams) should be extracted with hexane-acetone procedure or with acetonitrile and partitioned into hexane. The aliquot of hexane used is 1 ml to 1 gram of soil; concentrate to 5 mls; use 5  $\mu\text{l}$  for gas-chromatograph. If cleanup is required, use the same procedure as water samples.

8. Pesticides in Vegetation: Composites of vegetation; 100 grams are extracted with acetonitrile and partitioned into hexane. The aliquot of acetonitrile used is 1 ml acetonitrile to 1 gram vegetation. To clean up, use the same procedure as water samples.

9. Pesticides in Fish: Macerate the whole fish and take a 25 to 100 gram sample. To it add 5 percent to 10 percent isopropyl alcohol in hexane (1 ml solvent to 1 gram fish). In a Waring blender, mix at low speed for three minutes and decant the solvent three consecutive times. Wash the isopropyl alcohol out of the hexane with distilled water in a separatory funnel. Dry the hexane over anhydrous  $\text{Na}_2\text{SO}_4$ . Partition the pesticides from the hexane into 25 ml acetonitrile in a separatory funnel. Discard the hexane layer. Add 100 ml water to the acetonitrile and 25 ml hexane. Acidify the water portion, and the pesticide will partition into the hexane layer; repeat three times; then wash the hexane layer with 25 ml of water to remove any remaining acetonitrile. Proceed with a column chromatography cleanup. Either Florisil<sup>R</sup> or alumina column B to be used depends on individual sample.

## G. ACCURACY AND COMMENTS

### 1. Minimum Measurable Concentration of Pesticide:

Aldrin	5 ppt	Heptachlor	5 ppt
DDD	5 ppt	Heptachlor epoxide	5 ppt
DDE	5 ppt	Lindane	5 ppt
DDT	10 ppt	2, 4-D	100 ppt
Dieldrin	5 ppt	2, 4, 5-T	5 ppt
Endrin	5 ppt	Silvex	5 ppt

### 2. Discussion of the above minimum measurable concentration of pesticide.

a. Using the procedure, accurate analysis of most water samples can be routinely accomplished. Amounts less than the above detectable limits can be detected by analyzing a larger sample volume or reducing the volume of extract to less than 5 ml. Not all extracts, however, can be reduced to such a low volume without an accompanying buildup of excessive interferences. No other instrument except those mentioned above will accomplish the results. Other instruments are ten times less sensitive and require excessive cleanup.

b. Ultramicro analytical techniques must be used to determine nanogram concentrations of pesticides found in the environment. For analytical results to be meaningful, glassware should be properly washed and heat treated at 300°C. Extensive cleanup is required because interfering impurities are greater than pesticide found. Recovery of pesticides from the environment averages from 95 percent to 100 percent.

## REFERENCES

1. E. Brown and Y. A. Nishioka, "Pesticides in Water. Pesticides in Selected Western Streams--A Contribution to the National Program," Pesticides Monitoring Journal (Sept. 1967) Vol. 1, No. 2, 38-46.
2. M. J. deFaubert Maunden, H. Egen, E. W. Godley, E. W. Hammond, J. Roburn and J. Thompson, "Cleanup of Animal Fats and Dairy Products for the Analysis of Chlorinated Pesticides Residue," Analyst (1964), 89:168.
3. P. A. Mills, J. H. Onley, and R. A. Gaither, "Papid Method for Chlorinated Pesticides Residues in Nonfatty Foods," J. Assoc. Office Agr. Chemists, Vol. 46:186.
4. R. E. White, "Insecticide Analysis Procedures Used by Klamath Basin Study," paper presented at the Pacific Northwest Pollution Control Association, Vancouver, British Columbia (November 3-5, 1965), Federal Water Pollution Control Administration, U.S. Department of Health, Education, and Welfare, Klamath Falls, Oregon.

APPENDIX V

CALCULATION OF THEORETICAL BOD REMOVAL  
EFFICIENCY BY NRC FORMULA



1. NRC Formula:

$$E = \frac{100}{1 + 0.0085 \left( \frac{W}{VF} \right)^{1/2}}$$

Where: E = % BOD removal for filter process (filter recirculation, final sedimentation)

W = BOD loading to filter lbs/day

V = Filter volume (acre · feet)

F = Recirculation factor

$$F = \frac{1 + R}{(1 + 0.1R)^2}$$

R = Recirculation ration

$$R = \frac{Q^1 - Q}{Q}$$

Q = Influent sewage flow

Q<sup>1</sup> = Total filter flow including recirculation

2. Assumptions:

- a. Q = 1.15 MGD
- b. Q<sup>1</sup> = 1.15 + 0.096 = 1.25 MGD
- c. Primary Clarifier BOD Removal Efficiency = 30%
- d. Influent BOD = 146 mg/l

3. Calculation:

$$a. V = \pi \times (\text{filter radius squared}) \times (\text{filter depth}) \times \frac{1 \text{ Acre}}{43,560 \text{ Ft}^2}$$

$$= (3.14) (27.5^2) (3.16) \left( \frac{1 \text{ Acre}}{43,560} \right) = 0.172 \text{ Acre} \cdot \text{Ft}$$

$$b. W = 146 \text{ mg/l} \times 8.34 \times 1.15 \times (0.70) = 980 \text{ lbs/day. Total loading per filter therefore} = 980/2 = 490 \text{ lbs/day}$$

$$c. R = \frac{1.25 - 1.15}{1.15} = 0.087$$

$$d. \quad F = \frac{1 + 0.087}{(1 + 0.0087)^2} = 1.07$$

$$e. \quad E = \frac{100}{1 + 0.0085 \left( \frac{490}{(0.172) \times (1.07)} \right)^{1/2}} = 70\%$$

APPENDIX VI

ENVIRONMENTAL PROTECTION AGENCY GUIDELINES  
ON EFFLUENT QUALITY OBTAINABLE THROUGH  
THE APPLICATION OF SECONDARY TREATMENT

**ENVIRONMENTAL PROTECTION AGENCY REGULATIONS  
ON SECONDARY TREATMENT INFORMATION**

(40 CFR 133; 38 FR 22298, August 17, 1973)

- 30 Purpose.
- 31 Authority.
- 32 Secondary treatment.
- 33 Special considerations.
- 34 Sampling and test procedures.

Source: Secs. 304(i)(1), 301(b)(1)(B), Federal Water Pollution Control Act Amendments, 1972, P.L. 92-500.

**§ 133.100 Purpose.**

This part provides information on the level of effluent quality attainable through the application of secondary treatment.

**§ 133.101 Authority.**

The information contained in this part is provided pursuant to sections 304(i)(1) and 301(b)(1)(B) of the Federal Water Pollution Control Act Amendments of 1972, P.L. 92-500 (the

**§ 133.102 Secondary treatment.**

The following paragraphs describe the minimum level of effluent quality attainable by secondary treatment in terms of parameters biochemical oxygen demand, suspended solids, fecal coliform bacteria and pH. All requirements for a parameter shall be achieved except provided for in § 133.103.

- (a) *Biochemical oxygen demand (BOD).* (1) The arithmetic mean of the values for effluent samples collected in a period of 30 consecutive days shall not exceed 30 milligrams per liter.
- (2) The arithmetic mean of the values for effluent samples collected in a period of seven consecutive days shall not exceed 45 milligrams per liter.
- (3) The arithmetic mean of the values for effluent samples collected in a period of 30 consecutive days shall not exceed 15 percent of the arithmetic mean of the values for influent samples collected at approximately the same times

during the same period (85 percent removal).

(b) *Suspended solids.* (1) The arithmetic mean of the values for effluent samples collected in a period of 30 consecutive days shall not exceed 30 milligrams per liter.

(2) The arithmetic mean of the values for effluent samples collected in a period of seven consecutive days shall not exceed 45 milligrams per liter.

(3) The arithmetic mean of the values for effluent samples collected in a period of 30 consecutive days shall not exceed 15 percent of the arithmetic mean of the values for influent samples collected at approximately the same times during the same period (85 percent removal).

(c) *Fecal coliform bacteria.* (1) The geometric mean of the value for effluent samples collected in a period of 30 consecutive days shall not exceed 200 per 100 milliliters.

(2) The geometric mean of the values for effluent samples collected in a period of seven consecutive days shall not exceed 400 per 100 milliliters.

(d) *pH.* The effluent values for pH shall remain within the limits of 6.0 to 9.0.

**§ 133.103 Special considerations.**

(a) *Combined sewers.* Secondary treatment may not be capable of meeting the percentage removal requirements of paragraphs (a)(3) and (b)(3) of § 133.102 during wet weather in treatment works which receive flows from combined sewers (sewers which are designed to transport both storm water and sanitary sewage). For such treatment works, the decision must be made on a case-by-case basis as to whether any attainable percentage removal level

can be defined, and if so, what that level should be.

(b) *Industrial wastes.* For certain industrial categories, the discharge to navigable waters of biochemical oxygen demand and suspended solids permitted under sections 301(b)(1)(A)(i) or 306 of the Act may be less stringent than the values given in paragraphs (a)(1) and (b)(1) of § 133.102. In cases when wastes would be introduced from such an industrial category into a publicly owned treatment works, the values for biochemical oxygen demand and suspended solids in paragraphs (a)(1) and (b)(1) of § 133.102 may be adjusted upwards provided that: (1) the permitted discharge of such pollutants, attributable to the industrial category, would not be greater than that which would be permitted under sections 301(b)(1)(a)(i) or 306 of the Act if such industrial category were to discharge directly into the navigable waters, and (2) the flow or loading of such pollutants introduced by the industrial category exceeds 10 percent of the design flow or loading of the publicly owned treatment works. When such an adjustment is made, the values for biochemical oxygen demand or suspended solids in paragraphs (a)(2) and (b)(2) of § 133.102 should be adjusted proportionally.

**§ 133.104 Sampling and test procedures.**

(a) Sampling and test procedures for pollutants listed in § 133.102 shall be in accordance with guidelines promulgated by the Administrator pursuant to sections 304(g) and 402 of the Act.

(b) Chemical oxygen demand (COD) or total organic carbon (TOC) may be substituted for biochemical oxygen demand (BOD) when a long-term BOD:COD or BOD:TOC correlation has been demonstrated.

APPENDIX VII  
RECOMMENDED TREATMENT FACILITY LABORATORY  
SUPPLIES

#### 14.6 RECOMMENDED GENERAL LABORATORY SUPPLIES

Supplies needed in addition to apparatus listed for tests. Source: WPCF Publication No. 18, *Simplified Laboratory Procedures for Waste-water Examination*.

<u>Quantity</u>	<u>Description</u>
12	Pinch clamps, medium
200	Corks, assorted
1	Cork borer set, sizes 1 through 6
1	Cork borer sharpener
2 lb	Glass tubing, 8 mm
4	Thermometers, -20° to 100°C
40 ft	Rubber tubing, 1/4-in. ID, 3/32-in. wall
2 lb	Rubber stoppers, assorted (sizes 6 through 12)
1	Tripod, concentric ring, 6 in. OD
1	Latest edition, <i>Standard Methods for the Examination of Water &amp; Wastewater</i>
2	Funnels, 50 mm
2	Funnels, 100 mm
2 pair	Balance watch glasses, 3 in.
4	Beakers, Pyrex, 1000 ml
4	Beakers, Pyrex, 600 ml
6	Beakers, Pyrex, 400 ml
4	Beakers, Pyrex, 250 ml
4	Beakers, Pyrex, 100 ml
4	Beakers, Pyrex, 50 ml
2	Bunsen burners
2	Brushes, medium
2	Brush, B
2	Brush, A
2	Brush, Flask
2	Aprons, plastic, 42 in. length
3	Wire gauzes, 4 x 4 in.
3	Triangles, 2-1/2 in. per side
1 tube	Stopcock lubricant

# SUPPLEMENTAL EQUIPMENT FOR THE BOD TEST

<u>Quantity</u>	<u>Description</u>
12	Flask, Erlenmeyer, 500 ml
12	Flask, Erlenmeyer, 250 ml
2	Pipettes, volumetric, 25 ml
2	Pipettes, volumetric, 10 ml
2	Pipettes, volumetric, 5 ml
2	Flasks, volumetric, graduated to contain and deliver 1000 ml
2	Flasks, volumetric, graduated to contain and deliver 500 ml
2	Flasks, volumetric, graduated to contain and deliver 100 ml
6	Bottles, 32 oz
6	Bottles, 16 oz
6	Bottles, 8 oz
24	BOD bottles, with funnel opening
2	Burets, 50 ml
1	Buret clamp, double
2	Bottles, dropping, 30 ml
2	Spatulas, 75-mm blade
3	Bottles, storage, 2-1/2 gal
1	Buret support, medium
9 lb	Sulfuric acid, CP
5 lb	Sodium hydroxide pellets, CP
12	Bulb, rubber, pipette, 2 ml
24	Holder, rubber, stopper
4	Flask, volumetric, w/o stopper, 100 ml
2 lb	Potassium iodide, CP
1 lb	Starch, soluble potato
1 lb	Sodium thiosulfate, CP
5 lb	Manganous sulfate, CP
100 g	Sodium azide, CP
1 lb	Magnesium sulfate
1/4 lb	Ferric chloride
1 lb	Potassium phosphate, mono-basic
1 lb	Potassium phosphate, dibasic

<u>Quantity</u>	<u>Description</u>
1 lb	Sodium phosphate, dibasic heptahydrate
1/4 lb	Ammonium chloride
1 oz	Potassium bi-iodate, primary standard
1 lb	Potassium dichromate
10 g	Sodium diethyldithio carbamate
1	Incubator, BOD
1	Refrigerator
1 lb	Calcium chloride, 20 mesh

#### SUPPLEMENTAL EQUIPMENT FOR THE CHLORINE RESIDUAL TEST

<u>Quantity</u>	<u>Description</u>
1	Comparator, water analysis
1	Disc for comparator, chlorine
6 lb	Hydrochloride acid, CP
25 g	Orthotolidine dihydrochloride

#### SUPPLEMENTAL EQUIPMENT FOR SOLIDS ANALYSES

<u>Quantity</u>	<u>Description</u>
1	Brush, camel hair, 1-in. wide
1	Balance with cover
1	Weights, balance set, 50 g
12	Crucibles, Gooch, No. 4
2	Holder, crucible
2	Cylinder, graduated, 1000 ml
2	Cylinder, graduated, 500 ml
2	Cylinder, graduated, 250 ml
4	Cylinder, graduated, 100 ml
4	Cylinder, graduated, 50 ml
2	Cylinder, graduated, 25 ml
1	Cylinder, graduated, 10 ml
1	Desiccator, 250 mm
1	Desiccator plate
12	Dishes, evaporating, size 0



<u>Quantity</u>	<u>Description</u>
3	Flask, filtering, 500 ml
2	Pipettes, 25 ml
6	Pipettes, 10 ml
2	Pipettes, 5 ml
1	Hot plate, 660 w
2	Tongs, crucible
1	Tongs, furnace, 18 in.
8 ft	Tubing, rubber, (heavy) 1/4-in. ID
2	Filter pumps
1	Clock, interval timer, 2 hr
1	Furnace, muffle
2 boxes	Paper, filter, glass fiber, 2.4 cm
1	Water baths, four-hole
1	Balance, platform, triple beam
2	Bottles, washing, polyethylene, 500 ml
6	Pencils, wax, red
2 boxes	Filter paper, 12.5 cm, Whatman No. 41
1 bottle	Ink, marking, black
1 lb	Rod, glass, 6 mm
1	File, triangular, 4 in.
12	Bulb, rubber, pipet, 2 oz
1	Balance desiccator
1	Oven, drying
24	2.4 cm glass fiber filter
2	Buchner funnel, size 2A
6	Tube "T", connecting, 1/4-in.
5 lb	Drierite

**SUPPLEMENTAL EQUIPMENT FOR COLIFORM GROUP  
BACTERIA ANALYSES**

<u>Quantity</u>	<u>Description</u>
1	Sterilizer or autoclave
12	3 mm wire transfer loop
24	Pipets, measuring, 10 ml
48	Pipets, measuring, 1 ml, or quantity of disposable sterile pipets